BRITISH STANDARD

BS EN
15287-2:2008
Incorporating corrigendum November 2008

Chimneys — Design, installation and commissioning of chimneys

Part 2: Chimneys for roomsealed appliances

ICS 91.060.40

BSI British Standards

National foreword

This British Standard is the UK implementation of EN 15287-2:2008.

The UK participation in its preparation was entrusted to Technical Committee B/506, *Chimneys*.

National Annex NA (informative) identifies the provisions currently required to meet the UK devolved administrations Building Regulations for chimneys.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2008

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15287-2

March 2008

ICS 91.060.40

English Version

Chimneys - Design, installation and commissioning of chimneys - Part 2: Chimneys for roomsealed appliances

Cheminées - Conception, installation et mise en service des conduits de fumée - Partie 2 : Conduits de fumée pour chaudières étanches

Abgasanlagen - Planung, Montage und Abnahme von Abgasanlagen - Teil 2: Abgasanlagen für raumluftunabhängige Feuerstätten

This European Standard was approved by CEN on 10 February 2008.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

Page

Foreword

This document (EN 15287-2:2008) has been prepared by Technical Committee CEN/TC 166 “Chimneys”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2008, and conflicting national standards shall be withdrawn at the latest by September 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This European Standard is one of a series of specifications as listed below.

Chimneys – Design, installation and commissioning of chimneys – Part 1: Chimneys for non-roomsealed heating appliances.

Chimneys – Design, installation and commissioning of chimneys – Part 2: Chimneys systems for roomsealed appliances.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard describes the method of specifying the design, installation and labelling criteria for chimney systems, connecting flue pipes and air supply pipes for roomsealed heating applications. It also gives information on commissioning of an installed chimney.

This standard does not cover:

— chimneys designated H (high positive pressure chimneys), and chimneys designated P (normal positive pressure chimneys) serving more than one appliance,

— chimneys which serve a mixture of fan assisted or forced draught burners or natural draught appliances,

— installations having a configuration of the type C_2.

This European Standard does not apply to freestanding chimneys covered by EN 13084-1.

This standard also specifies limitations for supporting a chimney, and the maximum unsupported chimney height for system chimneys and custom built chimneys.

NOTE Roomsealed gas appliances are classified as type C according to CEN/TR 1749.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 771-1, *Specification for masonry units - Part 1: Clay masonry units*

EN 771-2, *Specification for masonry units - Part 2: Calcium silicate masonry units*

EN 1443: 2003, *Chimneys – General requirements*

EN 1457, *Chimneys — Clay/ceramic flue liners — Requirements and test methods*

EN 1806, *Chimneys – Clay/ceramic flue blocks for single wall chimneys - Requirements and test methods*

EN 1856-1, *Chimneys – Requirements for metal chimneys – Part 1: System chimney products*

EN 1856-2, *Chimneys – Requirements for metal chimneys – Part 2: Metal liners and connecting flue pipes*

EN 1857, *Chimneys – Components – Concrete flue liners*

EN 1858, *Chimneys – Components – Concrete flue blocks*

EN 1993-3-2, *Eurocode 3: Design of steel structures – Part 3-2: Towers, masts and chimneys – Chimneys*

EN 12446, *Chimneys – Components – Concrete outer wall elements*

EN 13063, *Chimneys – System chimneys with clay/ceramic flue liners – Part 1: Requirements and test methods for sootfire resistance*

EN 13063-2, *Chimneys – System chimneys with clay/ceramic flue liners – Part 2: Requirements and test methods under wet conditions*

EN 13063-3, *Chimneys - System chimneys with clay/ceramic flue liners - Part 3: Requirements and test methods for air flue system chimneys*

EN 13069, *Chimneys – Clay/ceramic outer walls for system chimneys – Requirements and test methods*

EN 13084-1, *Free-standing chimneys – Part 1: General requirements*

EN 13384-1: 2002, *Chimneys – Thermal and fluid dynamic calculation methods – Part 1: Chimneys serving one appliance*

EN 13384-2, *Chimneys – Thermal and fluid dynamic calculation methods – Part 2: Chimneys serving more than one heating appliance*

EN 13502, *Chimneys - Requirements and test methods for clay/ceramic flue terminals*

EN 14471, *Chimneys - System chimneys with plastic flue liners - Requirements and test methods*

EN 14989-1, *Chimneys - Requirements and test methods for metal chimneys and material independent air supply ducts for roomsealed heating applications - Part 1: Vertical air/flue terminals for C6-type appliances*

EN 14989-2, *Chimneys - Requirements and test methods for metal chimneys and material independent air supply ducts for roomsealed heating applications - Part 2: Flue and air supply ducts for room sealed appliances*

EN 15287-1:2007, *Chimneys - Design, installation and commissioning of chimneys - Part 1: Chimneys for non-roomsealed heating appliances*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1443:2003, EN 15287-1:2007 and the following apply.

NOTE 1 Examples of balanced air/flue configurations for roomsealed applications are given in Figures 1 and 2. The configurations of Figure 1 and Figure 2 may be created from converting or relining an existing chimney.

NOTE 2 The European scheme for the classification of gas appliances is given in CEN/TR 1749.

3.1
air supply duct
duct in a chimney system only for conveying combustion air to a room-sealed appliance

3.2
balanced flue chimney configuration
configuration where the air entry to the combustion air supply duct is adjacent to the discharge of combustion products from the flue, the inlet and outlet being so positioned that wind effects are substantially balanced

3.3
concentric chimney configuration
configuration in which the chimney flue is fully surrounded by the air supply duct

NOTE This includes chimney configurations where the flue duct and air supply duct do not share a common axis.

3.4
connecting air supply pipe
component or components connecting the heating appliance air supply to the chimney system air supply duct

3.5
connecting flue pipe
component or components connecting the heating appliance flue outlet to the flue duct of the chimney system

3.6
converted chimney
existing chimney for non roomsealed applications changed to a roomsealed chimney configuration

3.7
custom-built chimney for roomsealed heating applications
chimney configuration that is installed or built on-site using a combination of compatible components that may be from one or different sources

3.8
flue duct
the duct containing the flue of the chimney system

3.9
relined chimney
existing chimney where a liner is restored or replaced

NOTE The process of inserting a new liner into an existing chimney without a change of the air/flue configuration is also regarded as relining the chimney

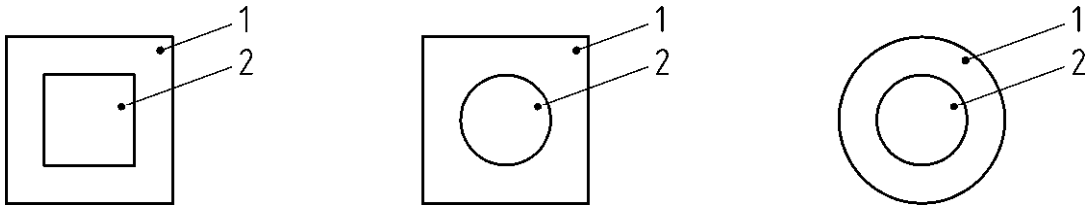
3.10
roomsealed appliance
appliance in which the combustion circuit (air supply, combustion chamber, heat exchanger and evacuation of the products of combustion) is sealed with respect to the room in which the appliance is installed

3.11
roomsealed chimney configuration
combination of both a flue duct and an air supply duct for roomsealed applications

3.12
separate chimney configuration
configuration in which the air supply duct and the chimney flue are separate

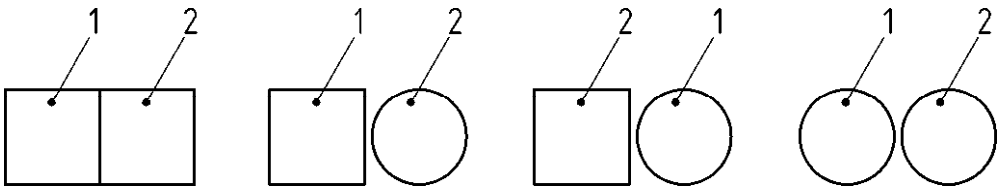
3.13
system chimney for roomsealed heating applications
chimney configuration that is installed using a combination of compatible components, obtained or specified from one manufacturing source with product responsibility for the whole roomsealed chimney configuration

NOTE This product is understood to constitute a kit under the Mandate M 105.



Key
1 flue gas
2 combustion air

Figure 1 — Concentric configurations



Key

1 flue gas

2 combustion air

Figure 2 — Separate configurations

4 Design

4.1 General

In order to design a chimney system installation, the following steps should be followed to achieve a safe chimney installation.

Specify whether the chimney system design is for a single appliance or multiple appliance application. Specify the type of multiple appliance configuration, i.e. whether cascade or multiple inlet.

The design shall specify whether the chimney configuration to be installed shall comprise two concentric or separate ducts.

Chimney system shall comply with national regulations and nationally accepted rules.

NOTE Where a chimney is approved together with the heating appliance, the information for flue sizing or the designation parameters not associated with the installation aspects are not necessary as the combination of appliance and chimney has been certificated together.

4.2 Data requirements

4.2.1 Sources of data and information

The data and information specified in 4.2.2 to 4.2.5 shall be obtained and documented as appropriate.

NOTE The sources may be:
-heating appliance manufacturer‘s literature,
-chimney manufacturer‘s literature including installation instructions,
-architects drawings or plans and/or site surveys,
-Annexes of this document (e.g. material characteristics),
-local building rules.
A possible source of typical or average data is EN 13384-1, and Annex A of this document.

4.2.2 Heating appliance information

The information for the heating appliance(s) in Annex B shall be obtained from the documentation of the heating appliance manufacturer or if not available, default values may be used (see Annex B of EN 13384-1:2002), but the source of the data shall be documented in the design (see 4.2.1).

4.2.3 Chimney system product specification

The following information about the chimney product specification shall be obtained:

— identification and designation of the system chimney or of the components for custom built chimneys or for relining an existing chimney (see also Annexes C, D and E);

— design load or maximum allowed chimney height to be supported by lengths, fittings and supports;

— weight of components where appropriate;

— manufacturer's installation instructions;

— terminals characteristics;

— condensate drainage system.

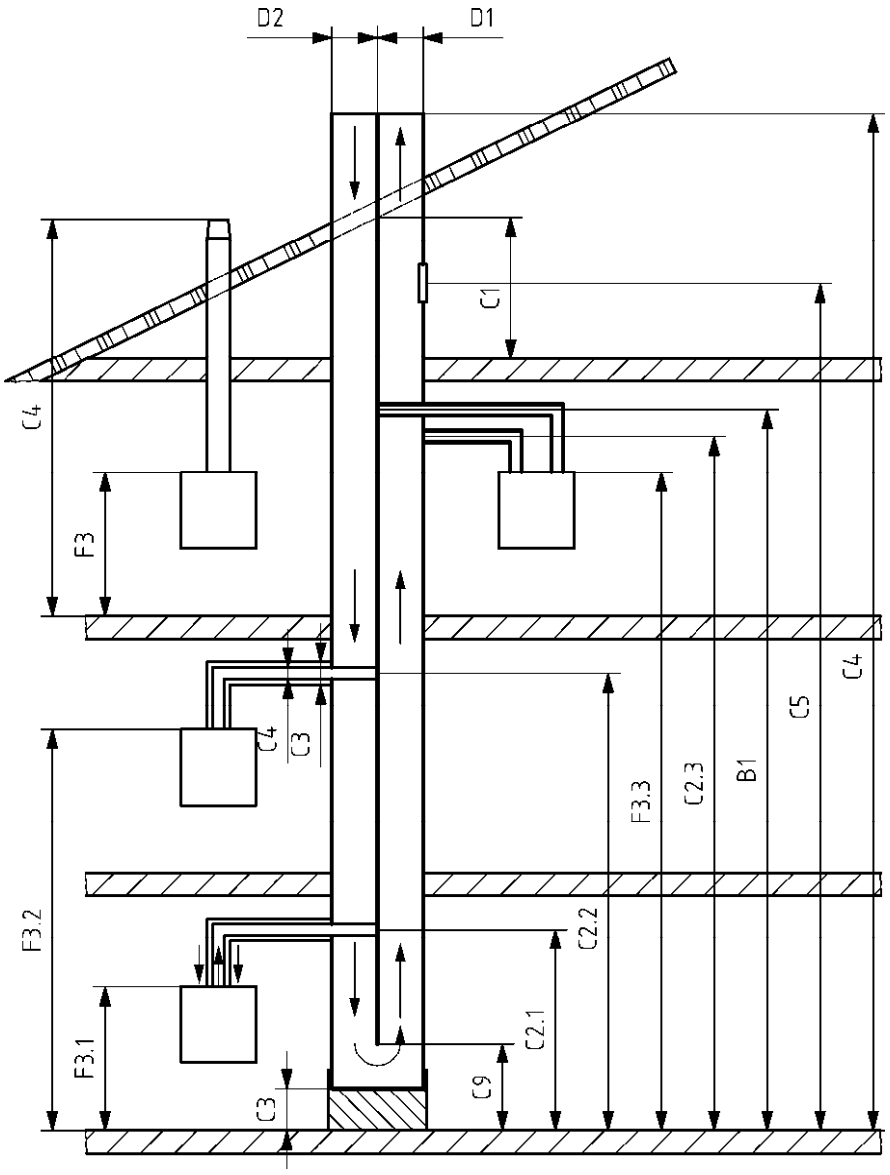
Additional information may be required for chimney sizing (see EN 13384-1 or EN 13384-2).

4.2.4 Building construction and chimney system route information

In order to allow the chimney route to be determined, the relevant details of the building or support structure shall be obtained (see Figure 3 and 4).

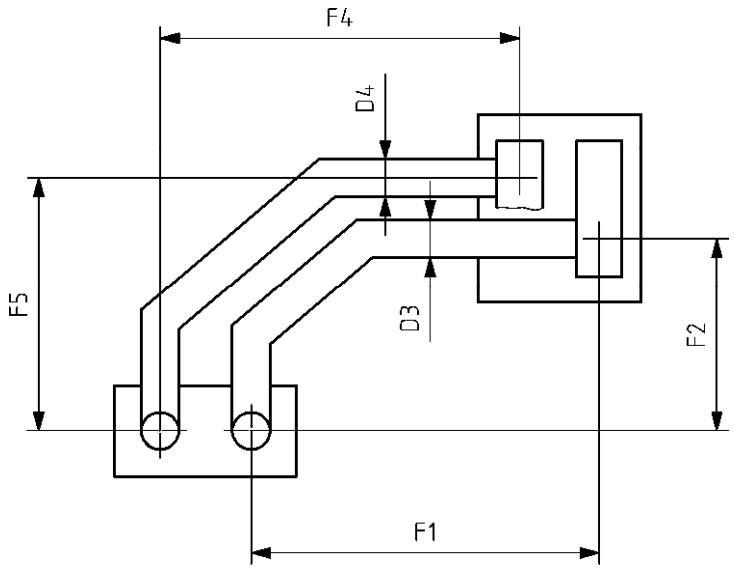
If the chimney is to be supported by the building structure, the construction of the building and the materials used shall be capable of supporting the loads imposed upon it by the chimney. The fixings shall be compatible with the materials of construction of the building. This shall be checked before installing the chimney.

Figure 3 is an example of a gas appliance type C_3 and a type C_4 installation, and Figure 4 is an example for connecting flue pipe and connecting air supply pipe dimensions for a C_4 application with separate ducts.



Key
See 4.2.4

Figure 3 - Example for roomsealed installations – dimensions



Key
See 4.2.4

Figure 4 — Example for connecting flue pipe and connecting air supply pipe dimensions for C_4 application with separate ducts

The following is a check list of information from which details of the building construction and chimney system construction and route shall be obtained.

The following list of information should be supplied where appropriate (see Figures 3 and 4):

— H1 height from ground to ceiling (structural or finished);

— H2 height from intermediary floor to ceiling (structural or finished);

— H3 height of ridge;

— γ pitch of roof;

— T1 depth and thickness of intermediate floor joist timbers and distances between centres;

— T2 depth and thickness of roof space floor joist timbers and distances between centres;

— T3 depth and thickness of roof timbers (rafters) and distance between centres;

— L1 horizontal distance between the centre line of the chimney above roof level and the gable end of the building;

— L2 horizontal distance between the centre line of the chimney above roof level and the ridge of the roof;

— C1 distance through loft measured at centre line of the chimney system;

— C2 height from the ground to the centre line of each flue inlet;

— C3 height from the ground to the bottom of the liner;

— C4 total chimney height from the ground to the chimney system outlet;

— C5 height from the ground to the centre of each access opening;

— C6 height from the ground to the lower bend of each offset where the centre line of the liner changes the direction;

— C7 vertical distance between the lower and upper bends of each offset where the centre line of the liner changes the direction;

— C8 horizontal distance between the vertical centre lines of each offset;

— C9 height from the ground to the centre line of the pressure equalising opening;

— B1 height from the ground to the centre line of each air inlet;

— F1 horizontal distance from the centre of appliance-outlet to the centre of the chimney;

— F2 horizontal distance from the centre of appliance-outlet to the centre of the inlet into the chimney;

— F3 height from ground to the centre of appliance outlet;

— F4 horizontal distance from the centre of the appliance air inlet to the centre of the vertical air supply duct;

— F5 horizontal distance from the centre of the appliance air inlet to the centre of the outlet of the vertical air supply duct;

— D1 internal dimensions of cross section of the flue throughout its length;

— D2 internal dimensions of cross section of the air supply duct throughout its length;

— D3 internal dimensions of cross section of the connecting flue pipe;

— D4 internal dimensions of cross section of the connecting air supply duct;

— materials of each floor;

— materials of each ceiling;

— roof finish.

Existing chimney details for relined and converted chimney:

— construction materials to determine thermal performance;

— condition and nature of inner flue surface of the existing chimney;

— structural details, e.g. position of inspection/cleaning access;

— proximity of chimney outlet position to adjacent buildings, obstructions and other building openings, e.g. windows/skylights, etc.

4.2.5 Local conditions

Topographical (e.g. altitude, outside temperature) particulars of the site shall be obtained as required in EN 13384-1.

4.3 Design requirements

4.3.1 General

Where a chimney is certified as an integral part of the appliance, the manufacturer's installation instructions are deemed to fulfil these design requirements.

The design of the chimney installation shall be detailed and documented. Manufacturer's product information may fulfil this requirement. The design should enable a chimney product manufacturer's standard components to be used in carrying out the installation. Modification of components, e.g. producing openings or adjustments of length may only be undertaken in accordance with manufacturer's instructions.

NOTE The finished chimney should have a designation in accordance with EN 1443 (see Annex F). The chimney products should be chosen that the designation reflects the suitability of the chimney for the intended use. Annex E gives an example for the designation of a metal system chimney and Annex F gives an example of the general designation of a chimney according to EN 1443. The finished chimney should have a chimney plate (see Annex G).

4.3.2 Chimney system designation

4.3.2.1 General

The chimney and connecting flue pipes, chimney adapter and appliance adapter shall have designation classes appropriate to the appliance details (see 4.2.2) and the building structure details (see 4.2.4).

The connecting flue pipe may have a designation different from that of the chimney, e.g. where the appliance output results in a positive pressure in the connecting flue pipe, but the chimney design is such that it provides sufficient draft to operate under negative pressure. The designation parameters for both the chimney and the connecting flue pipe shall be taken into account in the calculation according to EN 13384-1 and EN 13384-2 (see 4.3.4).

Each designation parameter shall be of a class at least equal to that required for the appliance serving the chimney or shall be of a higher class according to the following sequence:

— T600 > T450 > T400 > T300 > T250 > T200 > T160 > T140 > T120 > T100 > T080;

— P > N;

— W3 > W2 > W1;

— D3 > D2 > D1;

— W > D under the same corrosion load;

— Gxx > Oxx;

— xx(low) > xx(high);

where

T is the temperature class,

P is the positive pressure class,

N is the negative pressure class,

W is wet operating conditions,

D is dry operating conditions,

O is without sootfire resistance,

G is with sootfire resistance,

xx is the distance to combustibles,

and for corrosion resistance class :

for D and W:

1 is for gas and kerosene,

2 is for light oil and wood in open fires,

3 is for heavy oil and solid fuel (e.g. coal, peat and wood in closed fires).

4.3.2.2 System chimney for roomsealed application

The designation of an installed system chimney shall be according to the product standard:

— EN 13063-3 for clay/ceramic products;

— EN 14989-1 for metal products (see Note).

The designation of the corrosion resistance of an installed metal system chimney to EN 14989-1 shall be determined according to Annex H.

NOTE A terminal according to EN 14989-1 may be connected directly to the appliance to form a system chimney.

4.3.2.3 Separate air-/flue configuration for a custom built, relined or converted chimney, or connecting flue pipe

Determination of the designation of the flue duct or the connecting flue pipe for a separate air/flue configuration shall be in accordance with EN 15287-1:2007, 4.3.3.3 or 4.3.3.4.

NOTE 1 System chimney components according to EN 13063-1 and EN 13063-2, EN 1858, EN 1856-1 or EN 14471 can be used in conjunction with an air supply duct in this application to produce a custom built chimney.

NOTE 2 The air supply duct has no designation requirement, additional information may be required in accordance with G.2.

If the chimney consists of chimney components of different designations, then the chimney shall be designated to the lowest according to the sequence of 4.3.2.1.

4.3.2.4 Concentric air/flue configuration for a custom built, relined, or converted chimney or connecting flue pipe

The chimney or connecting flue pipe designation and essential additional information for a concentric flue/air supply duct configuration including terminal of a custom built, relined or converted chimney shall be determined according to Annex A or in accordance with national regulations or nationally accepted rules.

If the chimney consists of chimney components of different designations then the chimney shall be designated to the lowest according to the sequence of 4.3.2.1.

NOTE Specific examples for the determination of the designation of a converted/relined chimney is given in informative Annex I and for a custom built chimney is given in informative Annex J.

4.3.3 Properties of construction of the chimney

4.3.3.1 General

Supplementary materials not supplied with the chimney products shall be fit for purpose, e.g. in terms of corrosion, temperature, strength, jointing compounds (cements, mortars, seals, sealants or mastics), rendering, weatherproofing, sealing materials, fixings, screws or additional supports.

4.3.3.2 System chimney for roomsealed application

Materials for an installed system chimney shall be according to the product standard:

— EN 13063-3 for clay/ceramic products;

— EN 14989-1 for metal products (see Note).

NOTE A terminal according to EN 14989-1 may be connected directly to the appliance to form a system chimney.

4.3.3.3 Separate air/flue configuration for a custom built, relined or converted chimney

For a custom built or a relined chimney the materials of the flue duct for a separate air/flue configuration shall be in accordance with EN 15287-1:2007, 4.3.4.3.1 or 4.3.4.4.1.

For a converted chimney the existing chimney for a separate air/flue configuration shall be checked that it is fit for its intended use. Where there is a risk of loose or corrosive material from existing chimney entering the air supply duct, consideration should be given to an additional duct or re-facing any surfaces and any necessary work be carried out.

Air supply ducts may be of any material suitable for the environment inside or outside the duct (e.g. air supply temperature, heat radiation from the flue duct, durability, UV resistant, rigidity).

The air supply duct shall have a gas tightness meeting the requirements of Pressure class N2 of EN 1443.

The air supply duct shall be constructed in such a manner, especially so insulated, that no moisture at the outer surface of the air supply duct can occur caused by cooling of the air supply duct from cold combustion air entering from outside.

The flow resistance of the air supply duct shall be determined.

4.3.3.4 Concentric air/flue configuration for a custom built, relined or converted chimney

4.3.3.4.1 Custom built chimneys

####### 4.3.3.4.1.1 Flue ducts

Flue ducts for custom built chimneys shall be made from rigid flue liners in accordance with the requirements of EN 14989-2, EN 1457, EN 1856-2 or EN 1857.

For positive pressure and wet applications flue ducts and fittings, including any seal/sealant shall be confirmed as a combination for that pressure class and condensate resistance class.

NOTE Chimney products in accordance with EN 1806, EN 1856-1, EN 1858 and EN 14471 may also be used as flue ducts.

4.3.3.4.1.2 Insulation

Any insulation shall be approved to be fit for the intended use or be an air gap or in accordance with national regulations or nationally accepted rules.

The thermal resistance or the thermal conductivity of the insulation shall be obtained from the product manufacturer, or in the absence of this information, typical values are given in Table A.4.

If the insulation around the flue duct forms the inner wall of the air duct, it shall have a stable outer surface or be covered to prevent loose material entering the air duct.

NOTE Insulation should not prevent free movement of the duct.

4.3.3.4.1.3 Outer wall

The outer wall shall be of a material suitable for the conditions inside and outside the duct (e.g. air supply temperature, heat radiation from the flue duct, durability, UV resistant, rigidity).

Outer wall components in accordance with EN 12446, EN 1806, EN 1858, EN 13069 or as specified in Table A.5 are suitable.

4.3.3.4.1.4 Air supply duct

The air supply duct comprises the outer surface of the flue duct or any insulation and the inner surface of the outer wall or any other duct of the outer wall.

The air supply duct shall have a gas tightness meeting the requirements of pressure class N2 of EN 1443.

The air supply duct or outer wall shall be constructed in such a manner, especially so insulated, that no moisture at the outer surface of the air supply duct or the outer wall can occur caused by cooling of the air supply duct or outer wall from cold combustion air entering from outside.

The thermal resistance and the flow resistance of the air supply duct shall be determined.

4.3.3.4.2 Relined and converted chimney

4.3.3.4.2.1 Flue duct

Flue ducts for relining or converting shall be made from rigid flue liners in accordance with the requirements of EN 14989-2, EN 1457, EN 1856-2, EN 1857 or flexible chimney flue liners in accordance with the requirements of EN 1856-2.

For positive pressure and wet applications flue ducts and fittings, including any seals/sealants, shall be confirmed as a combination for that pressure class and condensate resistance class.

NOTE Chimney products in accordance with the requirements of EN 1806, EN 1856-1, EN 1858 and EN 14471 may also be used as flue ducts.

4.3.3.4.2.2 Insulation

Any insulation shall be approved to be fit for the intended use or be an air gap or in accordance with national regulations or nationally accepted rules.

The thermal resistance or the thermal conductivity of the insulation shall be obtained from the product manufacturer, or in the absence of this information, typical values are given in Table A.4.

If the insulation around the flue duct forms the inner wall of the air duct, it shall have a stable outer surface or be covered to prevent loose material entering the air duct.

NOTE Insulation should not prevent free movement of the duct.

4.3.3.4.2.3 Outer wall

The existing chimney will become the outer wall of the relined or converted chimney. It may be the outer wall of the air supply duct.

The existing chimney shall be checked that it is fit for its intended use and if necessary repaired. Where there is a risk of loose or corrosive material from existing chimney entering the air supply duct consideration should be given to an additional duct or re-facing any surfaces.

4.3.3.4.2.4 Air supply duct

The air supply duct comprises the outer surface of the flue duct or any insulation and the inner surface of the outer wall or any other duct of the outer wall.

The air supply duct shall have a gas tightness, meeting the requirements of pressure class N2 of EN 1443.

The air supply duct or the outer wall shall be constructed in such a manner, especially so insulated, that no moisture at the outer surface of the air supply duct or the outer wall can occur caused by cooling of the air supply duct or the outer wall from cold combustion air entering from outside.

NOTE The determination of this characteristic may be in accordance with national regulations or nationally accepted rules.

The thermal resistance and the flow resistance of the air supply duct shall be determined.

4.3.3.5 Connecting flue pipes, connecting air supply pipes, and adaptors

The material of metal connecting flue pipe shall comply with EN 1856-2.

Chimney components including adapters complying with EN 1457, EN 1806, EN 1856-1, EN 1857, EN 1858, EN 14771 can also be used.

The connecting air supply duct shall meet the requirements of 4.3.3.4.1.4 or 4.3.3.4.2.4.

4.3.3.6 Terminal for custom built, relined or converted chimney systems for roomsealed applications

Vertical terminals for balanced flue roomsealed chimney systems shall be in accordance with EN 14989-1 or terminals in accordance with national regulations or nationally accepted rules. Terminals for non-balanced roomsealed chimney systems shall be in accordance with EN 1856-1 and EN 13502 or terminals in accordance with national regulations or nationally accepted rules.

4.3.3.7 Supplementary components or additional materials

Supplementary components or additional materials shall have performance characteristics appropriate to the designation of the chimney configuration that affect them, e.g. operating temperature.

All fixings, e.g. screws, nuts, bolts, plugs, washers not supplied with the chimney products, shall be such that the assembly is non-combustible and remains secure at the operating temperature.

4.3.4 Chimney system sizing and characteristics for roomsealed applications

The flue duct, the connecting flue pipe, the air supply duct and terminal shall be characterised for size, pressure class and thermal parameters in accordance with the thermal and fluid dynamic calculation methods based on EN 13384-1 and EN 13384-2 or as specified by the heating appliance manufacturer or chimney manufacturer.

Where appropriate, the maximum allowable pressure difference between combustion air inlet and flue gas outlet of the heating appliance as specified by the manufacturer should be taken into account in the calculation.

4.3.5 Chimney system route

The chimney system route should be determined by the positions of the heating appliances flue outlet(s), air supply intake(s) and the point of chimney termination.

The chimney system route should be the shortest, most practicable direct route between the appliance outlet and the chimney outlet and should be as straight and as near to vertical as practicable, except for horizontal types, e.g. type C_1 and C_5. The non-balanced flue chimney outlet should be as near as practicable to the highest part of the building (e.g. ridge) to ensure adequate draught and dispersal of flue gas.

The chimney system route selected should enable the chimney manufacturer's standard components to be used in carrying out the installation.

For a chimney operating under wet conditions with multiple inlets, a means shall be provided for preventing condensate from re-entering an individual heating appliance. This may be achieved by ensuring that the entering position of the lowest connecting flue pipe is above the level of condensate collecting at the base of the chimney or in the collector.

Chimneys and connecting flue pipes route should be designed in such a way that the comfort of rooms is not adversely affected.

NOTE Attention should be given to heat emitted from the chimney and connecting flue pipe in applications where whole year operation is likely to affect comfort. A thermal resistance of 0,22 $m^2 \cdot K/W$ is recommended for temperature class T300 and above.

4.3.6 Connecting flue pipe and connection air supply pipe route

The connecting flue pipe and connecting air supply pipe shall not pass through a ceiling or into another fire compartment unless allowed in national regulations.

A connecting flue pipe designated suitable for wet operating conditions, shall be inclined to allow condensate to be drained.

A connecting flue pipe for a non-condensing heating appliance shall be connected to a chimney operating under wet conditions so that condensate cannot enter the heating appliance, e.g. by declining the connecting flue pipe to the chimney or providing a condensate trap.

NOTE 1 It is recommended that it should be inclined at least 3° to the horizontal.

NOTE 2 It is recommended that the connecting flue pipe should be as short as possible.

The appliance manufacturer's installation instructions shall be followed for any specific requirements.

4.3.7 Resistance to fire (external to external)

A chimney design shall enable the resistance to fire (external to external) required for the specific parts of the building through which it passes to be achieved. The required resistance to fire shall be classified in terms of EI (integrity and insulation). This may be achieved by one of the following:

— the system itself with the required resistance to fire,

— the system built into a shaft with the necessary resistance to fire,

— the system and its enclosure which together fulfil the necessary resistance to fire.

Where an installation design requires the use of fire stops, including those that act as combined fire stops and spacers or as ceiling/floor supports, in order to meet the criteria for resistance to fire (external to external), in the absence of specific European Standards, these shall be as tested according to national regulations for preventing the spread of fire.

4.3.8 Distance to combustible material (Resistance to fire internal to external)

4.3.8.1 System chimneys

The minimum distance to combustible materials for a system chimney declared by the manufacturer in accordance with the relevant product standards shall be used.

The minimum distance to combustible material for a chimney system supplied as an integral part of the heating appliance shall be in accordance with the heating appliance manufacturer's instruction.

A system chimney which passes through a combustible wall shall be sleeved and/or shielded to maintain the appropriate distance to combustible material or in the case of cavity wall construction to contain any infill. Any sleeve or shield opening to the outside of the building shall be weatherproofed.

The distance to combustible materials may be reduced where the expanse of the combustible material is small, e.g. skirting boards, rafters, joists, etc. In some circumstances the combustible material may touch. This shall only be allowed by individual member state's regulation.

4.3.8.2 Custom built, relined and converted chimneys

The minimum distance to combustible materials for a custom built, relined and converted chimney shall either be as declared by the manufacturer, or be determined in accordance with the calculation of Annex A.

NOTE 1 Equation A.1 covers the case of non-ventilated spaces between the chimney system and combustible material and gives the maximum allowed flue gas temperature for a given distance.

NOTE 2 Equation A.2 covers the case of ventilated spaces between the chimney system and combustible material and gives the maximum allowed flue gas temperature for a gap of a minimum 4 cm.

A custom built chimney which passes through a combustible construction shall be sleeved and/or shielded to maintain the appropriate distance to combustible material or in the case of cavity wall construction to contain any infill. Any sleeve or shield opening to outside shall be weatherproofed.

The distance to combustible materials may be reduced where the expanse of the combustible material is small, e.g. skirting boards, rafters, joists, etc. In some circumstances the combustible material may touch. This shall only be allowed by individual member state's regulation.

A concentric chimney system up to a temperature class T160 and where sootfire cannot occur requires no distance to combustibles and therefore no sleeve.

NOTE 3 A chimney relined with a liner having the same thermal characteristics as the previous liner may retain the existing distance to combustible material.

4.3.8.3 Connecting flue pipes

4.3.8.3.1 Concentric connecting flue pipe

A concentric connecting flue pipe up to a temperature class T160 and where sootfire cannot occur requires no distance to combustibles.

For a concentric connecting flue pipe with a higher temperature class, see 4.3.8.1 and 4.3.8.2.

4.3.8.3.2 Non-concentric connecting flue pipe

Where metal connecting flue pipes in accordance with EN 1856-2 are used, the given minimum distance to combustible materials declared by the manufacturer shall be used.

Unless otherwise specified:

— Other connecting flue pipes in temperature classes T100 to T160 and where sootfire cannot occur should be at a minimum distance of 40 mm from combustible materials, when installed in natural ventilated conditions or at a distance as calculated in Equation A.1.

— Naturally ventilated metal connecting flue pipes with a temperature class equal to or higher than T200 or where sootfire can occur shall be installed at a minimum distance to combustible materials of at least three times their nominal diameter. The minimum distance to combustible material may be reduced to 1,5 times the nominal diameter, if a radiation shield creating an air gap, made from non combustible material, is installed between the connecting flue pipe and the adjacent combustible materials.

For connecting flue pipes made of chimney products the minimum distance to combustible materials shall be according to 4.3.8.1 and 4.3.8.2.

A connecting flue pipe that passes through a combustible wall shall be sleeved and/or shielded to maintain the appropriate distance to combustible material or in the case of cavity wall construction to contain any infill. Any sleeve or shield opening to the outside shall be weatherproofed.

NOTE Connecting flue pipes in temperature class T080 do not require a minimum distance to combustible materials. However, direct contact with combustible material is not recommended.

4.3.9 Accidental human contact

Where there is a risk of accidental human contact (see Table A.6) and the chimney is not otherwise completely enclosed, the design shall incorporate a shield or safety guard. It shall be fitted in accordance with the chimney manufacturer’s or chimney designer’s instruction.

4.3.10 Accidental ignition of extraneous loose material

Where the chimney is not otherwise completely enclosed and there is a risk of ignition of extraneous loose material by combustible material being placed adjacent to the chimney, the design shall incorporate a shield or safety guard. It shall be fitted in accordance with the chimney manufacturer’s instruction.

4.3.11 Supports

Chimneys shall be adequately supported, either by foundations or support brackets attached to the building structure, or another free-standing structure e.g. a mast or windshield. Where the building is to support the chimney, the building structure shall be capable of supporting the load both vertical and lateral.

If a system chimney or a custom-built chimney is supported by a free-standing structure or windshield, the construction of the support shall comply with EN 13084-1.

The limitations of height and separation from buildings regarding free-standing externally installed chimney sections are given in 4.3.17. The appliance shall not support the weight of the chimney except when the appliance manufacturer states in his instruction that the load bearing capacity is sufficient and where cleaning of the chimney can be undertaken without dismantling.

The liner manufacturer's instructions for supporting the liner shall be followed. Where the liners are to be supported on a lintel or foundations at the base of the chimney they shall be adequate for the liner load, including any condensate collectors, cleaning and inspection elements, and T-pieces or elbows.

4.3.12 Joints

Joints shall be in accordance with the manufacturer's instructions.

The design shall be such that joints between system chimney sections in accordance with EN 1856-1 shall not be placed inside a ceiling or floor unless allowed in national regulations.

4.3.13 Chimney offset

The design shall ensure that offsets are supported in accordance with the manufacturer’s instructions.

4.3.14 Access for inspection, cleaning and measuring

Access to the flue shall be available so that the full length of the chimney from the appliance adapter to the chimney outlet can be inspected and where it is required the chimney can be cleaned. An access should be made available in the vicinity of offsets of more than 30° or any offset which otherwise could not be inspected or cleaned.

An access shall be located only in areas where there is no risk from fire or explosion.

The fittings used to provide an access shall be a component compatible with the chimney or liner.

Access for cleaning may be possible from the bottom or the top of the chimney, the loft access, connecting flue pipe or through the heating appliance where the appliance manufacturer’s instructions allow.

If access is obtained by disassembling chimney fittings or disassembling the connecting flue pipe from the appliance or removing the appliance, this shall be done following the chimney or appliance manufacturer’s instruction.

NOTE Where a chimney is to be cleaned from the top a safe working environment should be available.

Where flue gas analysis is required and a facility is not provided in association with the heating appliance a pressure tight test point should be provided in the connecting flue pipe. It is recommended that such a measuring point be positioned at a distance of twice the internal diameter in straight length from the appliance outlet.

4.3.15 Distance between openings in the chimney system

Openings such as for cleaning access and any appliance connection into the same flue shall be separated by at least one nominal diameter from one another except where the configuration for such openings are otherwise demonstrated to evacuate products of combustion adequately.

4.3.16 Back ventilation

Where back ventilation is required between the liner and the next wall of the chimney construction (e.g. for positive pressure systems), the gap between the liner and the next wall of the chimney construction shall be sufficient to ensure adequate ventilation (see NOTES). The ventilation of the space shall be continuous from the boiler room or the bottom of the chimney to the outside atmosphere.

NOTE 1 The recommended minimum gap between the liner and the next wall of the chimney construction is 30 mm except where a circular liner is bounded by a square section wall when the minimum gap may be 20 mm.

The air inlet and outlet apertures and/or grills to the ventilation gap shall not restrict the back ventilation.

NOTE 2 The air inlet to the cavity and the air outlet should have the same flow area as the cross section of the ventilated gap.

Access should be provided for inspecting and where necessary cleaning the gap.

4.3.17 Location of chimney outlet

The chimney outlet shall be positioned to allow adequate evacuation and dispersal of combustion products and to avoid re-entry through openings into the building.

The location of the chimney outlet shall be in accordance with national and/or local regulations.

Where no national requirements exist, Annex K gives an example for chimney outlet positions for residential heating or comparable applications, which has been developed on the basis of typical known national rules.

For non-balanced flue applications it is important to take account of the location of the chimney outlet in order to ensure adequate evacuation of the products of combustion. A terminal positioned in a pressure zone caused by wind effects around a building is subject to adverse pressure. The values for the wind velocity pressure are defined in EN 13384-1 and EN 13384–2.

The chimney outlet is considered to be in an adverse pressure zone if the chimney outlet position is less than 0,4 m above the ridge and the distance of a horizontal line from the chimney outlet to the intersection with the roof is less than 2,3 m, and the chimney outlet is situated:

— on a roof with a slope of more than 40°, or

— on a roof with a slope of more than 25° if the opening for combustion air and the top of the chimney are on different sides of the ridge and horizontal distance from the top to the ridge is more than 1,0 m.

NOTE 1 A chimney may also be considered to be adversely affected by the proximity of adjacent obstructions e.g. buildings, trees, mountains. A chimney outlet within 15 m from adjacent structures which extends over a horizontal angle of 30° and their upper boundary raises more than 10° above the horizon as seen from the terminal outlet may be affected by wind turbulence. This may be overcome by an aerodynamic terminal.

Termination inside this zone is possible if terminals with specified aerodynamic properties are applied, sufficient to generate a negative pressure at the outlet of the chimney to overcome positive pressure wind effects or ensuring adequate positive pressure generated e.g. by the heating appliance.

Other dimensions, e.g. the prohibited zone (see Figure K.2, key 2), are related to safety or environmental issues e.g. flue gas re-entry and not the functioning capability of the chimney.

NOTE 2 For other applications e.g. involving industrial heating plant or process venting, the determination of the chimney outlet position may require other criteria, such as calculations for the dispersal of combustion products related to nearby surroundings.

For balanced flue applications it is important to take account of the location of the chimney outlet in order e.g. to prevent flue gas backflow into the living areas (see Figure K.2 and Table K.2).

4.3.18 External parts

4.3.18.1 General

The maximum allowed height of external parts of chimneys shall be subject to the following limiting conditions as specified in EN 13084-1:

— the horizontal distance between the building and the chimney outer wall not to exceed 1 m,

— the distance between the supports not to exceed 4 m,

— the distance above the last structural attachment not to exceed 3 m.

4.3.18.2 System chimneys

The maximum height of external parts of system chimneys shall be in accordance with the relevant product standards (EN 1856-1, EN 1858, EN 13063-1, EN 13063-2, EN 13063-3, EN 14471).

The spacing of supports and unsupported height declared by the manufacturer shall not be exceeded.

4.3.18.3 Custom-built chimneys

If not otherwise proven, e.g. to the relevant part of EN 13084, the maximum height of external sections of custom-built chimneys shall be in accordance with national regulations or nationally accepted rules, or:

— for metal chimneys, not more than 1,5 m above the last support, if the thickness of the load carrying wall has a minimum thickness equal to 1/200 of the diameter and the distance between lateral supports below external sections does not exceed 2 m;

— for chimneys having a masonry outer wall, a maximum unsupported height of 4,5 times the least cross sectional dimension, but not more than 3 m or be supported according to the outer wall element product standards EN 13069 (clay) or EN 12446 (concrete);

The distance above the last attachment to a building may be extended by propping, use of lateral supports or guy wires or use of masts.

All props, struts, guy wire designs and masts shall be in accordance with EN 1993-3-2.

The wall supports of custom-built-chimneys shall be rigid against lateral movement when fixed.

Wall fixings shall be used in accordance with manufacturer's instructions and be suitable for the materials of the construction of the wall which itself shall be capable of transmitting the load to ground.

4.3.19 Weatherproofing

Where the chimney passes through a roof or wall a proprietary component or material shall be used to provide weatherproofing at the appropriate angle of the roof slope and only the correct components shall be used. Where flashings are constructed on site, the design and application shall be in accordance with the roof and chimney design.

Where rain may penetrate the chimney cladding, rendering, or painting, according to the design and compatible with the substrate may be used, taking into account any freeze thaw requirements.

Weatherproofing shall be undertaken with materials having a temperature capability appropriate to the outer wall surface temperature.

NOTE The outer surface temperature may be taken from the manufacturer's product information or calculated using one of the equations in Annex L.

Where the chimney is sootfire designated the weatherproofing material shall be non-combustible.

Where the weatherproofing material has a higher water vapour diffusion resistance than the chimney construction, ventilation may be required between the outer wall of the chimney and the weatherproofing construction.

Where the system or design requires back ventilation, the weatherproofing shall not cause a restriction to the back ventilation.

If parts of the chimney are to be painted, the paint system shall be compatible with the substrate.

4.3.20 Lightning protection

Where lightning protection for the building is required the chimney shall also have lightning protection, either separately or via the lightning protection for the building.

4.3.21 Earthing of chimney systems

Consideration should be given to earthing protection of metal chimneys. National regulations and nationally accepted rules shall be considered.

4.3.22 Silencer

When a silencer is found necessary, the pressure loss characteristic and its influence on system capacity shall be included in the flue size calculation (see 4.3.4). The silencer shall have its own structural support and shall be installed in accordance with the silencer manufacturer instructions.

4.3.23 Condensate drainage system

Consideration shall be given to condensate disposal.

Where the condensate is to be discharged into the public sewerage system, local regulations apply.

NOTE Local regulations may specify the quality of the condensate entering the public sewerage system, i.e. by using a neutraliser.

Where condensation from the flue gas is expected and it is not intended to drain this condensate through the appliance condensate drainage system a separate chimney condensate drainage system shall be fitted.

In positive pressure systems the condensate drainage shall have a pressure resistance of at least two times the positive pressure in the chimney. This pressure resistance may be obtained for example by installing a trap. Any pipe work shall have a minimum diameter of 12 mm as the connection in the drainage system. Where freezing is likely, protection against freezing shall be provided.

4.3.24 Rain cap

Where rain water can enter the chimney system and is otherwise not disposed of (see 4.3.25) a rain cap may be provided, except as required by national regulations. The rain cap may be integral with a terminal. The rain cap shall not prohibit the cleaning of the chimney. Where ice formation is a risk (e.g. in condensing applications), terminals preventing ice formation shall be used (e.g. in accordance with EN 14989-1).

When a rain cap is installed, the pressure loss characteristic and its influence on system capacity shall be included in the flue sizing.

4.3.25 Rainwater disposal

Where rainwater is collected in the chimney system or in the heating appliance, a rainwater drainage system is recommended. It may be a condensate drainage system.

4.3.26 Terminals

The terminal shall be chosen to have a temperature class, condensate resistance class, corrosion resistance class and sootfire resistance class appropriate to the chimney designation. In addition the following properties may be appropriate:

— downdraught resistance,

— ice/rain resistance,

— freeze-thaw resistance, and

— any aerodynamic properties appropriate to the outlet location (see 4.3.17).

4.4 Chimney plate and additional information

The chimney plate and additional information shall be in the language of the country of installation.

The plate shall be permanent and indelibly marked, e.g. engraved metal plate, impressed or printed plastic plate.

The plate shall carry a warning that the plate shall not be covered or defaced.

The following information should be included on the chimney plate:

— installed chimney system designation determined in accordance with 4.3.2;

— nominal flue duct size;

— thermal resistance of the flue duct at the nominal working temperature;

— flow resistance information where available;

— installer's identification (name/address/telephone);

— date of installation;

— chimney system location if the plate is not attached to the chimney.

Where appropriate the following additional information should be made available which could be either on the chimney plate or in additional documents:

— flue duct manufacturer identification, e.g. CE marking information;

— product designations according to EN 1457, EN 1806, EN 1856-1, EN 1856-2, EN 1857, EN 1858, EN 13063-1, EN 13063-2, EN 13502, EN 14471, EN 14989-1 and EN 14989-2;

— information about air supply duct, e.g. size, material;

— silencer;

— intermediate cleaning access;

— cleaning method;

— neutralisation unit;

— information about offset, e.g. number, angles.

NOTE Examples of a chimney plate are given in Annex G.

5 Installation

5.1 General

The design for chimney systems using system chimneys, custom built chimneys, relined and converted chimneys and the product manufacturer's installation instructions shall be followed. The construction shall be in accordance with the national regulations or nationally accepted rules (see Annex M).

NOTE 1 It is recommended that the installation is done only by a competent installer.

NOTE 2 Information on checking, handling and site storage of materials and components is given in Annex J.

Chimney system components shall not be modified unless specifically allowed by the component manufacturer.

Additional items shall not be attached which affect structural stability or performance or cleaning capability, e.g. TV and radio aerials.

NOTE 3 Special attention should be paid to the following items:
- location of centralising spacers,
- the pulling force/load on installing flexible liners,
- alignment of liners,
- alignment of fittings to avoid undue stress/strain.

5.2 Construction of relined or converted chimney systems

Sufficient openings in the existing chimney shall be prepared for the installation of the required components into the chimney. The entry of the appliance connection/connecting flue pipe into the chimney shall be in accordance with 4.3.6.

Any opening in existing chimneys shall only be made with methods suitable to create a sufficient opening without damage of the existing structure.

For installation of the new liner from the top of the chimney, a safe working area shall be available.

All temporary openings shall be closed with suitable material to achieve the resistance to fire and thermal resistance required for the relined or converted chimney systems appropriate to the application. Ensure that free movement of the liner is maintained.

5.3 Chimney plate

The chimney plate shall be completed in accordance with 4.4. The chimney plate shall be fixed in a visible position.

NOTE 1 Possible locations are by the cleaning/inspection access, the side of the fireplace, at the chimney inlet or possibly by the electricity-gas-water-meter.

NOTE 2 The chimney plate may be supplied by the system chimney product manufacturer or liner manufacturer.

Examples of a chimney plate are given in Annex G.

6 Commissioning/handover

After finishing the installation the chimney system shall be commissioned to ensure that it has been correctly installed.

In the absence of specific instruction from the product manufacturer concerning commissioning, a recommended checklist of items is given in Annex N.

On satisfactory completion of the commissioning all relevant documentation shall be handed over to the user or his agent.

NOTE The documentation should include recommendations for inspection, cleaning and maintenance. See Annex O.

Annex A
(normative)

Determination of the chimney and connecting flue pipe system designation and essential additional information for custom built, relined and converted chimney systems, for concentric flue/air supply duct configuration

A.1 General

This annex describes the calculations to determine the individual designation classes in accordance with EN 1443 and how to arrive at other essential information for a concentric flue/air supply duct configuration.

The flue duct of a concentric roomsealed chimney system may comprise rigid flue liners in accordance with the requirements of EN 14989-2, EN 1457, EN 1856-2, EN 1857 or flexible chimney flue liners in accordance with the requirements of EN 1856-2 or chimney products in accordance with of EN 1806, EN 1856-1, EN 1858, EN 14471.

The correlation between the product designation and the designation in accordance with EN 1443 is given in Table D.1 for clay/ceramic flue liners and flue blocks, and in Table D.2 for concrete flue liners and flue blocks.

A.2 Temperature class

The temperature class is dependent on the materials in use and the outer surface temperature of the air supply duct (see Figure A.1).

The temperature class shall be one of the following:

a) The temperature class is determined from the lowest of the following:

— the temperature equal or lower than the lowest usable temperature of any of the materials of the construction; the usable temperature shall be taken from the designation of a chimney component or, in the absence of this information, typical values may be taken from Table A.1;

— the temperature class of a concrete or clay construction tested in accordance with EN 12446 or EN 13069 respectively.

Table A.1 — Examples of materials used for insulation/outer wall of the chimney and their maximum allowed temperature class

material	temperature class
brick	T600
concrete	T600
stainless steel	T600
aluminium	T200
cast iron	T600
clay/ceramic	T600
mineral wool	T400
ceramic fibre	T600
glass-fibre	T400
mild steel	T600
copper	T300

b) The temperature class is determined from the lowest of the following:

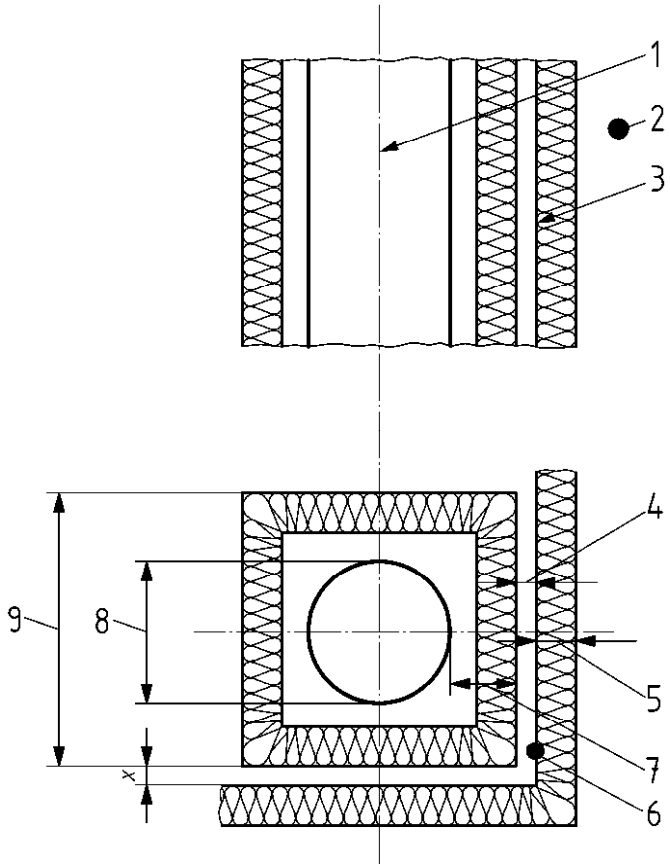
— the temperature equal or lower than the lowest usable temperature of any of the materials of the construction; the usable temperature shall be taken from the designation of a chimney component or, in the absence of this information, typical values may be taken from Table A.1;

— the limiting flue gas temperature (t_{calc}) that will ensure the maximum temperature allowed on combustible material is not exceeded. This can be calculated using Equation (A.1) or (A.2) depending on the distance from combustible materials and whether the gap between the chimney and the adjacent combustible materials is ventilated or not. Use Table A.2 to determine the temperature class;

— where human contact has to be considered and no safety guard is fitted, the limiting flue gas temperature (t_{calc}) that will ensure the maximum outer surface temperature allowed for human contact is not exceeded. This can be calculated using Equation (A.2). Use Table A.2 to determine the temperature class.

Table A.2 — permitted range of t_{calc} for each temperature class

value of t_{calc}	temperature class
$t_{calc} \geq 100$ °C	T080
$t_{calc} \geq 120$ °C	T100
$t_{calc} \geq 150$ °C	T120
$t_{calc} \geq 170$ °C	T140
$t_{calc} \geq 190$ °C	T160
$t_{calc} \geq 250$ °C	T200
$t_{calc} \geq 300$ °C	T250
$t_{calc} \geq 350$ °C	T300
$t_{calc} \geq 500$ °C	T400
$t_{calc} \geq 550$ °C	T450
$t_{calc} \geq 700$ °C	T600



Key

1 t_{calc}
2 t_c
3 $(1/\Lambda)_{sp}$
4 t_u
5 $(1/\Lambda)_{sp}$
6 t_u
7 $(1/\Lambda)$
8 D_{ni}
9 D_{ha}

Figure A.1 — Example of calculation parameters

Equation (A.1) may be used for a known value of $(1/\Lambda)_W$ and a surface temperature of adjacent combustible materials of 85 °C:

$$t_{calc} = \frac{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_h}{D_{haB}} \cdot \left(\frac{1}{\Lambda}\right)_{sp}}{\frac{D_h}{D_{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_w + \frac{1}{\alpha_a}\right]} \cdot (t_c - t_u) + t_c \text{, in °C} \qquad \text{(A.1)}$$

Equation (A.2) may be used for a naturally ventilated space *x* with at least 40 mm to combustible materials. Take the corresponding value for the maximum temperature class allowed in Table A.1.

$$t_{calc} = \frac{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot}}{\frac{D_h}{D_{haB} \cdot \alpha_a}} \cdot \left(t_{aB} - t_u\right) + t_a \text{, in °C} \qquad \text{(A.2)}$$

where

t_{calc}	is the calculated flue gas temperature	in °C
α_i	is the internal coefficient of heat transfer	in W/(m²·K)
α_a	is the external coefficient of heat transfer	in W/(m²·K)
$(1/\Lambda)_{tot}$	is the total thermal resistance of the chimney or connecting flue pipe system	in m²·K/W
$(1/\Lambda)_{sp}$	is the thermal resistance of the space between chimney or connecting flue pipe system and adjacent combustible materials	in m²·K/W
$(1/\Lambda)_w$	is the thermal resistance of the adjacent wall with a combustible inner surface	in m²·K/W
D_{haB}	is the outer diameter of the chimney or connecting flue pipe system	in m
D_h	is the inner diameter of the chimney (liner) or the connecting flue pipe	in m
t_c	is the combustible surface temperature	in °C
t_u	is the ambient temperature	in °C
t_{aB}	is the temperature at the outer surface of the chimney or connecting flue pipe system	in °C

The total thermal resistance of the chimney or connecting flue pipe system shall be calculated with Equation A.3:

$$\left(\frac{1}{\Lambda}\right)_{tot} = \left(\frac{1}{\Lambda}\right) + \frac{D_{ha}}{D_h} \cdot \left(\frac{1}{\Lambda}\right)_{spB} + \frac{D_{hiB}}{D_h} \cdot \left(\frac{1}{\Lambda}\right)_B \text{ in } \frac{m^2 \cdot K}{W} \qquad \text{(A.3)}$$

where

$(1/\Lambda)$	is the thermal resistance of the flue duct	in m²·K/W
D_{ha}	is the outer diameter of the flue duct	in m
D_h	is the inner diameter of the chimney (liner) or the connecting flue pipe	in m
$(1/\Lambda)_{spB}$	is the thermal resistance of the ventilated air gap	in m²·K/W
D_{hiB}	is the inner diameter of the air duct	in m
$(1/\Lambda)_B$	is the thermal resistance of the air supply duct	in m²·K/W

$(1/\Lambda)_n$ is the thermal resistance of the individual wall *n* in $m^2 \cdot K/W$

The thermal resistance of a multi wall flue duct shall be calculated with Equation A.4:

$$\left(\frac{1}{\Lambda}\right) = y \cdot \sum_n \left[\frac{D_h}{2 \cdot \lambda_n} \cdot \ell n\left(\frac{D_{h,n} + 2 \cdot d_n}{D_{h,n}}\right)\right] \text{ in } \frac{m^2 \cdot K}{W} \quad \text{(A.4)}$$

or where thermal resistance of the individual walls $\left(\frac{1}{\Lambda}\right)_n$ are known with Equation A.5:

$$\left(\frac{1}{\Lambda}\right) = D_h \cdot \sum_n \left[\left(\frac{1}{\Lambda}\right)_n \cdot \frac{1}{D_{h,n}}\right] \text{ in } \frac{m^2 \cdot K}{W} \quad \text{(A.5)}$$

where

$(1/\Lambda)$ is the thermal resistance flue duct in $m^2 \cdot K/W$

$(1/\Lambda)_n$ is the thermal resistance of the individual wall *n* in $m^2 \cdot K/W$

y is the coefficient of form
= 1,0 for round and oval cross-sections
= 1,10 for square and rectangular cross-sections up to a ratio of a side of 1:1,5

λ_n is the coefficient of thermal conductivity of the material of the individual wall at its mean temperature (see Table A.3, A.4, A.5) in $W/(m \cdot K)$

D_h is the inner diameter of the chimney (liner) or the connecting flue pipe in m

$D_{h,n}$ is the internal hydraulic diameter of the individual wall *n* in m

d_n is the thickness of the individual wall in m

The thermal resistance of an individual wall $\left(\frac{1}{\Lambda}\right)_n$ may be determined using Equation A.6:

$$\left(\frac{1}{\Lambda}\right)_n = y \cdot \frac{D_{h,n}}{2 \cdot \lambda_n} \cdot \ell n\left(\frac{D_{h,n} + 2 \cdot d_n}{D_{h,n}}\right) \text{ in } m^2 \cdot K/W \quad \text{(A.6)}$$

where

$D_{h,n}$ internal hydraulic diameter of the individual wall in m

d_n thickness of the individual wall in m

y coefficient of form
= 1,0 for round and oval cross-sections
= 1,10 for square and rectangular cross-sections up to a ratio of a side of 1:1,5

λ_n coefficient of thermal conductivity of the material of the individual wall at the operating mean temperature (see Table A.4 and A.5) in W/(m·K)

The influence of the thermal bridges for metal system chimneys should be taken into account by a factor described in EN 1859.

The thermal resistance of the air supply $(1/\Lambda)_{spB}$ can be taken from Table A.3.

Table A.3 — Thermal resistance of closed air gaps, dependent on the air gap width and the surface temperature of the heat emitting wall (concentric annular clearance, vertically arranged)

Temperature at the surface of the heat emitting wall	Width of the air gap				
	10 mm	20 mm	30 mm	40 mm	50 mm
40 °C	0,123	0,147	0,153	0,152	0,150
100 °C	0,087	0,101	0,101	0,100	0,099
150 °C	0,065	0,075	0,075	0,074	0,074
200 °C	0,050	0,055	0,055	0,055	0,054

NOTE For closed air gaps greater than 50 mm and temperatures higher than 200 °C a value of 0 is recommended in the absence of confirmed alternative data.

Alternatively:

For a outer surface temperature of the flue duct t_a less or equal 200 °C and a width of the gap of the air supply d_{spB} between 1 and 5 cm, the thermal resistance of the air supply $(1/\Lambda)_{spB}$ can be calculated with Equation A.4. In all other cases it should to be taken as 0.

$$\left(\frac{1}{\Lambda}\right)_{spB} = 0{,}1165 - 0{,}000488 \cdot t_a + 0{,}00000065 \cdot t_a^2 + \left(4{,}36 - 0{,}0351 \cdot t_a + 0{,}000082 \cdot t_a^2\right) \cdot d_{spB} - \left(58 - 0{,}46 \cdot t_a + 0{,}0011 \cdot t_a^2\right) \cdot d_{spB}^2 \quad \text{in m}^2\text{.K/W} \qquad (A.7)$$

where

$(1/\Lambda)_{spB}$ is the thermal resistance of the ventilated air gap in m²·K/W

t_a is the temperature at the outer surface of the flue duct in °C

d_{spB} width of the gap of the air supply in m

NOTE The calculating is done assuming a closed air gap to be on the safe side.

The thermal resistance of a multi wall air supply duct shall be calculated with Equation A.8:

$$\left(\frac{1}{\Lambda}\right)_B = y \cdot \sum_n \left[\frac{D_{hiB}}{2 \cdot \lambda_n} \cdot \ell n\left(\frac{D_{h,n} + 2 \cdot d_n}{D_{h,n}}\right)\right] \text{ in } \frac{m^2 \cdot K}{W} \qquad (A.8)$$

or where thermal resistance of the individual walls $\left(\frac{1}{\Lambda}\right)_n$ are known with Equation A.9:

$$\left(\frac{1}{\Lambda}\right)_B = D_{hiB} \cdot \sum_n \left[\left(\frac{1}{\Lambda}\right)_n \cdot \frac{1}{D_{h,n}}\right] \text{ in } \frac{m^2 \cdot K}{W} \qquad (A.9)$$

where

$(1/\Lambda)_B$ is the thermal resistance air supply duct in m²·K/W

$(1/\Lambda)_n$ is the thermal resistance of the individual wall *n* in m²·K/W

y is the coefficient of form

= 1,0 for round and oval cross-sections

= 1,10 for square and rectangular cross-sections up to a ratio of a side of 1:1,5

λ_n is the coefficient of thermal conductivity of the material of the individual wall at its mean temperature (see Table A.3, A.4, A.5) in W/(m·K)

D_{hiB} is the inner hydraulic diameter of the air supply duct in m

$D_{h,n}$ is the internal hydraulic diameter of the individual wall *n* in m

d_n is the thickness of the individual wall in m

The thermal resistance of an individual wall $\left(\frac{1}{\Lambda}\right)_n$ may be determined using Equation A.6.

The thermal resistance of the space between chimney or connecting flue pipe system and adjacent combustible materials shall be taken from Table A.3 or calculated with Equation A.8:

$$\left(\frac{1}{\Lambda}\right)_{sp} = 0{,}1165 - 0{,}000488 \cdot t_{aB} + 0{,}00000065 \cdot t_{aB}^2 + \left(4{,}36 - 0{,}0351 \cdot t_{aB} + 0{,}000082 \cdot t_{aB}^2\right) \cdot x - \left(58 - 0{,}46 \cdot t_{aB} + 0{,}0011 \cdot t_{aB}^2\right) \cdot x^2 \quad \text{in } \frac{m^2 \cdot K}{W} \qquad \text{(A.10)}$$

for 0,01 m ≤ x ≤ 0,05 m:

where

$(1/\Lambda)_{sp}$ is the thermal resistance of the space between chimney or connecting flue pipe and adjacent combustible materials in m²·K/W

y is the coefficient of form

= 1,0 for round and oval cross-sections

= 1,10 for square and rectangular cross-sections up to a ratio of a side of 1:1,5

t_{aB} is the temperature at the outer surface of the chimney or connecting flue pipe in °C

x is the distance from the outer surface of the chimney or the connecting flue pipe to the surface of the combustible material (width of the air gap) in m

The following values shall be used:

— for the inner diameters

equal or greater than 0,2 m the actual diameter;

less than 0,2 m D_h= 0,2 m.

— For diameters less than 0,2 m the diameters of the individual walls n of the chimney shall be adjusted by the difference in the actual diameter and the 0,2 m specified value.

— for the internal and external coefficient of heat transfer:

α_i = 15 W/(m²·K);

α_a = 8 W/(m²·K).

— and for the temperatures:

t_c = 85 °C;

t_u = 20 °C;

t_{aB} = 100 °C for fire protection;

t_{aB} for human contact where the chimney is not shielded against human contact see Table A.6.

NOTE t_{calc} is the calculated value dependent on the thermal resistance of the construction which gives the maximum allowed temperature to fulfil the requirements for the adjacent combustible material and/or for human contact (for examples of calculations see Annex I and J).

The thermal conductivity or resistance values of the individual walls shall either be those given by the product manufacturer or otherwise the default values of Tables A.4 to A.5 may be used.

Table A.4 – Thermal conductivity in W/(m.K) for insulation materials (EN 1443)

Material	20 °C	100 °C	200 °C	300 °C
mineral wool, open	0,043	0,080	0,109	0,150
mineral wool, ventilated	0,049	0,080	0,109	0,170
mineral wool, plates	0,037	0,053	0,073	0,100
mineral wool, shell	0,042	0,049	0,070	0,102
vermiculite	0,062	0,076	0,096	0,126

NOTE These default values include a safety factor of 1,2 to take account of manufacturing tolerances.

Table A.5 – Thermal conductivity in W/(m.K) for outer wall materials

	mean temperature			
material		**20 °C**	**100 °C**	**200 °C**
bricks bricks with full structure vertically perforated bricks with closed structure bricks for filling purposes	1200 kg/m³	0,60	0,63	0,66
	1600 kg/m³	0,82	0,86	0,90
	2000 kg/m³	1,15	1,20	1,26
bricks vertically perforated bricks with perforation degree A and B	600 kg/m³	0,40	0,44	0,50
	800 kg/m³	0,47	0,52	0,59
	1000 kg/m³	0,54	0,59	0,67
concrete light weight concrete with closed structure	800 kg/m³	0,47	0,51	0,55
	1200 kg/m³	0,74	0,81	0,87
	1600 kg/m³	1,20	1,32	1,42
	2000 kg/m³	1,92	2,11	2,26
concrete light weight concrete with open structure	800 kg/m³	0,34	0,37	0,40
	1200 kg/m³	0,55	0,60	0,65
	1600 kg/m³	0,90	0,97	1,06
	2000 kg/m³	1,44	1,55	1,70
concrete light weight concrete with open structure (natural basis)	600 kg/m³	0,22	0,24	0,27
	900 kg/m³	0,34	0,38	0,42
	1200 kg/m³	0,49	0,46	0,61
concrete light weight concrete with open structure, only expanded concrete	600 kg/m³	0,23	0,26	0,28
	900 kg/m³	0,36	0,40	0,45
	1200 kg/m³	0,53	0,58	0,66
	1500 kg/m³	0,72	0,80	0,89
stainless steel		17	17	17

Where accidental human contact is possible, the maximum allowable outer surface temperatures of Table A.6. shall be used.

Table A.6 — Maximum allowable outer surface temperatures where accidental human contact is possible

Material of the outer surface	Maximum allowed temperature
metal – bare	70 °C
metal – painted 50 µm	80 °C
metal –enamelled 160 µm	75 °C
metal – plastic covered 400 µm	98 °C
plastic	93 °C
ceramic, glass	85 °C
concrete, marble	80 °C
NOTE The values in Table G.6 are based on the criteria in EN ISO 13732-1 relating to a 1 s burn threshold.	

The surface and mean temperatures of the individual walls shall be calculated iteratively till the estimated values are not less then the calculated values.

For the check that the estimated surface and mean temperatures of the individual walls are not too low, Equation A.11 can be used:

$$t_{\mathrm{m},n} = \frac{t_n + t_{n+1}}{2} \text{ in °C} \tag{A.11}$$

where

$$t_{n+1} = t_n - \frac{\mathrm{y} \cdot \frac{D_\mathrm{h}}{2 \cdot \lambda_n} \cdot \ell n\left(\frac{D_{\mathrm{h},n} + 2 \cdot d_n}{D_{\mathrm{h},n}}\right)}{\frac{1}{\alpha_\mathrm{i}} + \left(\frac{1}{\Lambda}\right)_\mathrm{tot} + \frac{D_\mathrm{h}}{D_\mathrm{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_\mathrm{sp} + \left(\frac{1}{\Lambda}\right)_\mathrm{w} + \frac{1}{\alpha_\mathrm{a}}\right]} \cdot \left(t_\mathrm{calc} - t_\mathrm{u}\right) \text{ in °C} \tag{A.12}$$

or where thermal resistance of the individual walls $\left(\frac{1}{\Lambda}\right)_n$ are known with:

$$t_{n+1} = t_\mathrm{n} - \frac{\frac{D_\mathrm{h}}{D_{\mathrm{h},n}} \cdot \left(\frac{1}{\Lambda}\right)_n}{\frac{1}{\alpha_\mathrm{i}} + \left(\frac{1}{\Lambda}\right)_\mathrm{tot} + \frac{D_\mathrm{h}}{D_\mathrm{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_\mathrm{sp} + \left(\frac{1}{\Lambda}\right)_\mathrm{w} + \frac{1}{\alpha_\mathrm{a}}\right]} \cdot \left(t_\mathrm{calc} - t_\mathrm{u}\right) \text{ in °C} \tag{A.13}$$

The inner surface temperature of the flue duct $t_\mathrm{i} = t_1$ (first inner wall n=1) can be calculated using

$$t_1 = t_\mathrm{calc} - \frac{\frac{1}{\alpha_\mathrm{i}}}{\frac{1}{\alpha_\mathrm{i}} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_\mathrm{h}}{D_\mathrm{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_\mathrm{sp} + \left(\frac{1}{\Lambda}\right)_\mathrm{w} + \frac{1}{\alpha_\mathrm{a}}\right]} \cdot \left(t_\mathrm{calc} - t_\mathrm{u}\right) \text{ in °C} \tag{A.14}$$

For a flue duct with N individual walls, the temperature of the outer surface of the flue duct is $t_\mathrm{a} = t_{\mathrm{N}+1}$.

The inner surface temperature of the air supply duct $t_\mathrm{iB} = t_{\mathrm{N}+2'}$ (first inner wall n = N+2) can be calculated using:

$$t_{N+2} = t_a - \frac{\frac{D_h}{D_{ha}} \cdot \left(\frac{1}{\Lambda}\right)_{spB}}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_h}{D_{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_{sp} + \left(\frac{1}{\Lambda}\right)_{w} + \frac{1}{\alpha_a}\right]} \cdot \left(t_{calc} - t_u\right) \text{ in °C} \quad \text{(A.15)}$$

where

$t_{m,n}$	is the mean temperature of the individual wall n	in °C
t_n	is the temperature at the inner surface of the individual wall n	in °C
t_{n+1}	is the temperature at the outer surface of the individual wall n	in °C
t_{calc}	is the calculated flue gas temperature	in °C
α_i	is the internal coefficient of heat transfer	in W/(m²·K)
$(1/\Lambda)_{tot}$	is the thermal resistance of the chimney or connecting flue pipe system	in m²·K/W
D_h	is the inner diameter of the chimney (liner) or the connecting flue pipe	in m
D_{haB}	is the outer diameter of the air supply duct	in m
$(1/\Lambda)_{sp}$	is the thermal resistance of the space between chimney or connecting flue pipe system and adjacent combustible materials	in m²·K/W
$(1/\Lambda)_w$	is the thermal resistance of the adjacent wall with a combustible inner surface	in m²·K/W
α_{aB}	is the external coefficient of heat transfer	in W/(m²·K)
t_u	is the ambient temperature	in °C
y	is the coefficient of form = 1,0 for round and oval cross-sections = 1,10 for square and rectangular cross-sections up to a ratio of a side of 1:1,5	
λ_j	is the coefficient of thermal conductivity of the material of the individual wall j at its mean temperature	in W/(m·K)
$D_{h,n}$	is the internal hydraulic diameter of the individual wall n	in m
d_n	is the thickness of the individual wall n	in m
$(1/\Lambda)_n$	is the thermal resistance of the individual wall j	in m²K/W
t_a	is the temperature at the outer surface of the flue duct	in °C
D_{ha}	is the outer hydraulic diameter of the flue duct	in m

For calculation with Equation A.2 is $\left(\frac{1}{\Lambda}\right)_{sp} = 0$ and $\left(\frac{1}{\Lambda}\right)_{w} = 0$.

A.3 Pressure class

The chimney or connecting flue pipe system shall be designated with the pressure class of the flue liner including any seals, and jointed according to the manufacturer instructions otherwise the chimney shall be designated either N1 or N2, dependent on the flue liner or fitting which has the lesser designation.

A.4 Resistance to condensate class

The chimney or connecting flue pipe system should be designated with the condensate resistance class of the flue liner including any seals, and jointed according to the manufacturer instructions otherwise the chimney shall be designated D.

A.5 Corrosion resistance class

The chimney or connecting flue pipe system jointed according to the manufacturer instructions should be designated with the lesser corrosion resistance class of the flue liner, connecting flue pipe or fittings including any seals, except for metal chimneys.

The installed metal chimney or connecting flue pipe system shall have the corrosion resistance class 1 where the metal liner designation according to EN 1856-2 is V1, or corrosion resistance class 2 where it is V2, or 3 where it is V3. Where the flue liner is designated Vm the chimney shall be designated 1, 2, or 3 according to national regulations prevailing for the material comprising the flue liner or connecting flue pipe (see Annex E).

NOTE The materials of the flue liner and connecting flue pipe included in the designation according to EN 1856-2 may be the subject of national regulation with respect to the corrosion load in the chimney (the combination of condensate resistance and corrosion resistance) and designers are advised to check local regulations with regard to allowed materials having the appropriate specification (material type and thickness). Informative Annex E lists the correlation between the flue liner or connecting flue pipe material specification and corrosion load claimed to exist in the various member states at the time of publication of the standard.

A.6 Sootfire resistance class

A chimney or connecting flue pipe system may be designated sootfire resistant (G) if:

— the liner or connecting flue pipe and fittings are at least designated as sootfire resistant, and

— insulation is declared from the liner manufacturer suitable for use in sootfire applications, or insulation is declared by the insulation manufacturer as usable for a temperature of at least 900 °C, and

— the air supply duct (outer wall) is to EN 12446, designated at least T400 and G or EN 13069 designated T600 (and passed the thermal shock test) or chimney products to EN 1806 and 1858 designated at least T400 and G or the air supply duct (outer wall) is made according to Table A.7, and

— any jointing material is suitable for sootfire resistant applications.

Other chimney or connecting flue pipe systems shall be designated "O".

Table A.7 — Materials for outer walls for sootfire resistance chimneys not tested for distance to combustible material

Classes	Standard	Minimum temperature class	Minimum wall thickness without test
bricks	EN 771-1	T400	11,5 cm
sand stone	EN 771-2	T400	11,5 cm
clay outer wall elements	EN 13069	T600	not determined

A.7 Distance to combustible material

The distance to combustible materials should be the greater of that in accordance with national regulations or nationally accepted rules or according to the following criteria:

For non-sootfire resistant chimneys the distance to combustible material should be taken from A.2.

For sootfire resistant chimneys the distance to combustible material should be the higher of the distance:

— established for the normal operation according to A.2, and

— designated in accordance with the product standard or if the outer wall is made of the materials of Table A.7 the distance between the chimney and a combustible wall is dependent on the materials and their thickness, but at least 40 mm and the space is naturally ventilated.

A.8 Thermal resistance of the flue duct

Use the result of the calculation from Equation A.4 or A.5.

A.9 Coefficient of flow resistance of the flue duct

Determine the sum of the coefficients of flow resistance due to a directional and/or cross sectional and/or mass flow change in the flue duct, the air supply duct and the terminal.

A.10 Thermal resistance of the air supply duct

Use the result of the calculation from Equation A.8 or A.9.

A.11 Coefficient of flow resistance of the air supply duct

Determine the sum of the coefficients of flow resistance due to a directional and/or cross sectional and/or mass flow change in the flue duct, the air supply duct and the terminal.

Annex B
(informative)

Information for the heating appliance(s)

For selecting the chimney type (required designation):

— kind/type of appliance(s)/burner(s);

NOTE An example for a gas appliance is type C63 (C13, C33).

— kind of fuel;

— maximum/nominal flue gas temperature;

— for wet chimneys, the information if condensate from the chimney is allowed to flow back through the appliance.

For sizing the chimney (see 4.3.4):

— kind/type of appliance/burner;

— kind of fuel;

— maximum and where there is a range minimum flue gas mass flow
(or burning rate and related CO_2-content
or heat input and related CO_2-content
or heat output, boiler efficiency and related CO_2-content);

— minimum flue gas temperature for maximum/nominal and for minimum heat output;

— minimum draught (for negative pressure chimneys) or maximum differential pressure (for positive pressure chimneys);

— CO_2-content (if not previously provided);

— size/shape of flue gas outlet;

— minimum and maximum allowable pressure difference between combustion air inlet and flue gas outlet if required by the appliance;

— maximum allowable temperature of combustion air if required by the appliance;

— size/shape of combustion air inlet.

For appliance/connecting flue pipe/chimney adapter and combustion air supply/connecting air pipe/appliance adaptor design/choice:

— size/shape of flue gas outlet;

— position/height of flue gas outlet;

— size/shape of combustion air inlet;

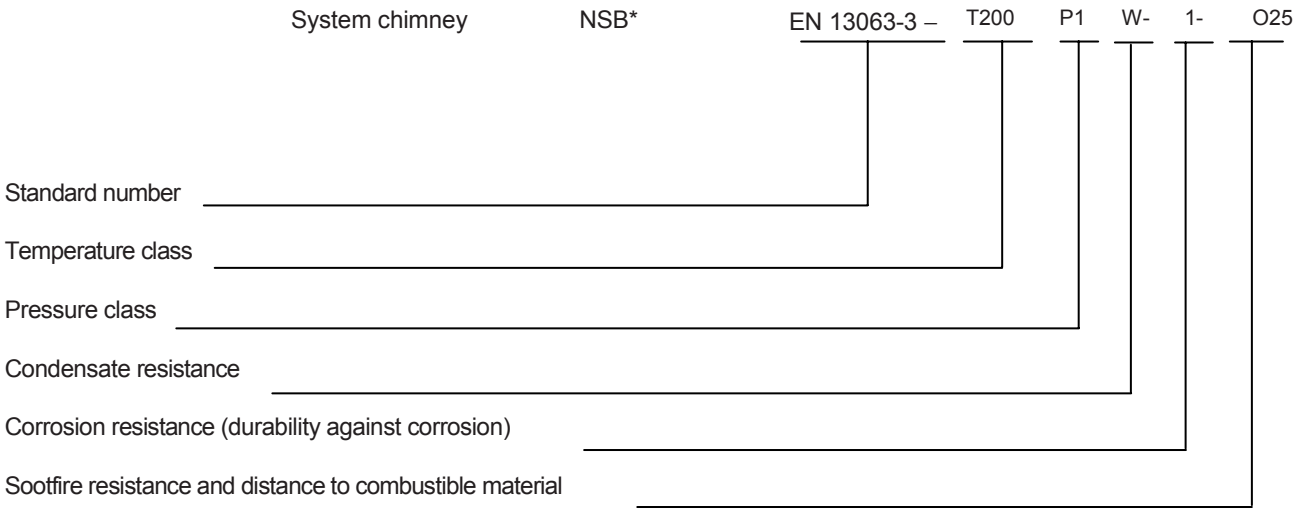
— position/height of combustion air inlet;

For terminal design/choice:

— maximum allowed CO_2-content in the combustion air (re-circulation) if required by the appliance.

Annex C
(informative)

Example of system chimney product designation



(*) NSB = National Standards Body (CEN Member)

Annex D
(informative)

Correlation between designation parameters for clay/ceramic flue liners and clay/ceramic flue blocks and concrete flue blocks

Table D.1 — Correlation between designation parameters for clay/ceramic flue liners and flue blocks

Designation of EN 1457	Designation of EN 1806	Designation according to EN 1443
A1N2	FB1N2[a]	T600 N2 D 3 G
	FB1N1[a]	T600 N1 D 3 G
A2N2	FB2N2[a]	T600 N2 D 3 O
A2N1	FB2N1[a]	T600 N1 D 3 O
A2P1		T600 P1 D 3 O or T600 P1 W 2 O
B1N2		T400 N2 D 3 G
B1N1		T400 N1 D 3 G
B2N2	FB3N2[a]	T400 N2 D 3 O or T400 N2 W 2 O
B2N1	FB3N1[a]	T400 N1 D 3 O or T00 N1 W 2 O
B2P1		T400 P1 D 3 O or T400 P1 W 2 O
C1N2	FB6[b]	T300 N2 D 3 O
C1N1		T300 N1 D 3 O
C2N2	FB4N2[a]	T300 N2 D 3 O or T300 N2 W 2 O
C2N1	FB4N1[a]	T300 N1 D 3 O or T300 N1 W 2 O
C2P1		T300 P1 D 3 O or T300 P1 W 2 O
D1N2		T200 N2 D 3 O
D1N1		T200 N1 D 3 O
D2N2		T200 N2 D 3 G or T200 N2 W 2 O
D2N1		T200 N1 D 3 G or T200 N1 W 2 O
D3N2	FB5N2[a]	T200 N2 D 3 O or T200 N2 W 2 O
D3N1	FB5N1[a]	T200 N1 D 3 O or T200 N1 W 2 O
D3P1		T200 P1 D 3 O or T200 P1 W 2 O

[a] non-bonding block type

[b] bonding block type

Table D.2 — Correlation between designation parameters for concrete flue liners and concrete flue blocks

Designation of EN 1857	Designation of EN 1858	Designation according to EN 1443
A1N2	FB1N2[a]	T600 N2 D 3 G
	FB1N1[a]	T600 N1 D 3 G
A2N2	FB2N2[a]	T600 N2 D 3 O
A2N1	FB2N1[a]	T600 N1 D 3 O
A2P1		T600 P1 D 3 O or T600 P1 W 2 O
B1N2		T400 N2 D 3 G
B1N1		T400 N1 D 3 G
B2N2	FB3N2[a]	T400 N2 D 3 O or T400 N2 W 2 O
B2N1	FB3N1[a]	T400 N1 D 3 O or T400 N1 W 2 O
B2P1		T400 P1 D 3 O or T400 P1 W 2 O
C1N2	FB6[b]	T300 N2 D 3 O
C1N1		T300 N1 D 3 O
C2N2	FB4N2[a]	T300 N2 D 3 O or T300 N2 W 2 O
C2N1	FB4N1[a]	T300 N1 D 3 O or T300 N1 W 2 O
C2P1		T300 P1 D 3 O or T300 P1 W 2 O
D1N2		T200 N2 D 3 O
D1N1		T200 N1 D 3 O
D2N2		T200 N2 D 3 G or T200 N2 W 2 O
D2N1		T200 N1 D 3 G or T200 N1 W 2 O
D3N2	FB5N2[a]	T200 N2 D 3 O or T200 N2 W 2 O
D3N1	FB5N1[a]	T200 N1 D 3 O or T200 N1 W 2 O
D3P1		T200 P1 D 3 O or T200 P1 W 2 O

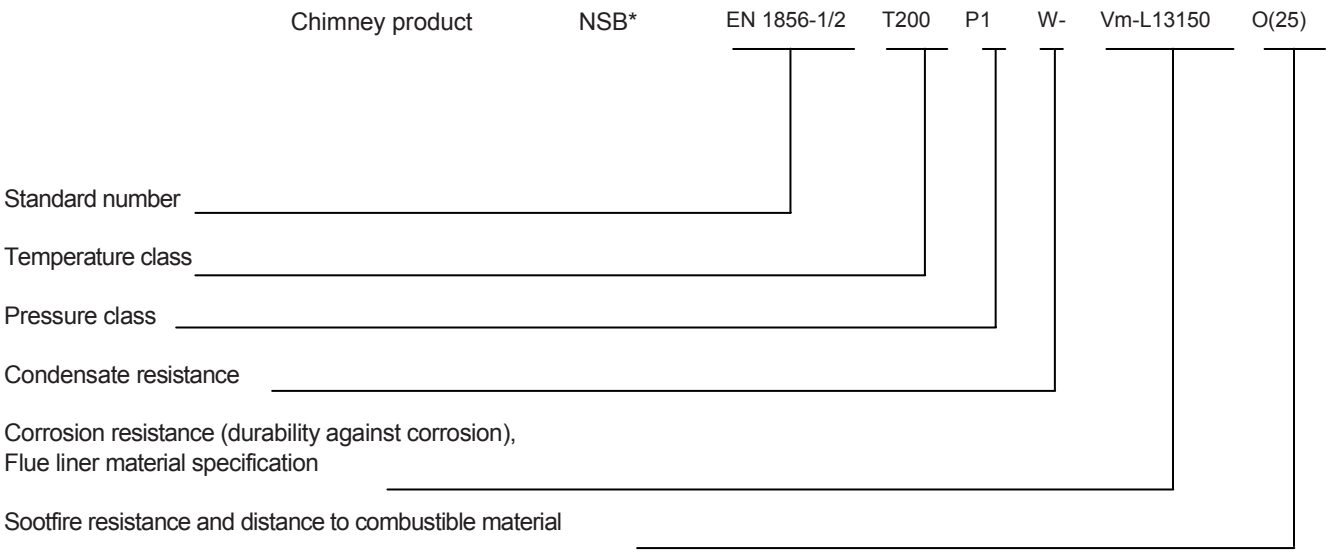
[a] non-bonding block type

[b] bonding block type

Annex E
(informative)

Designation of metal system chimneys and correlation between metal liner material designation and corrosion load in Member States (MS)

Example of metal chimney product designation



(*) NSB = National Standards Body (CEN Member)

Table E.1 — Multi-wall system chimneys

	Corrosion load							
designation	**Austria**	**Finland**	**France**	**Germany**	**Italy**	**Switzerland**	**UK**	**other countries[h)]**
L 11030							D2[1)a)]	
L 11040		D1	D1			D1		D1
L 11070				D1				
L 11150	D1/W1	W1	W1	W1	D1/W1	W1	W1	W1
L 20030			D2[1)]					
L 20040		D2[1)]				D1	D2[1)]	D2[1)]
L 20060							D3[6)]	
L 30030			D2					
L 30040								D2[2)]
L 30060						D2[5)]		
L 30100		D2[2)]						
L 40040			W1					
L 40060		W1		D2[1)]		W1	W1	W1
L 40100		D3[3)]				D2[1)]		
L 50030			D3[4)]					
L 50040			W2[1)]				D3	D2
L 50050		D3[4)]						D3[4)]
L 50060	D3/W3			D3[4)]/W1	D3	D2		
L 50100		D2			D3/W1	D3[4)]		
L 60030			D3					
L 60060		W2[1)]		D3			W2[1)]	W2[1)]
L 60100		D3				D3		D3
L 70060				W2[1)]	D3/W2	W2[1)]		

[1)] without wood

[2)] without wood in closed fire

[3)] without heavy oil and wood/oil

[4)] without wood/oil

[5)] only for gas and for wood in open fire

[6)] without solid fuel

[a)] for temperature class higher than T250 only D1

[h)] where a country is not listed it is under column "other countries"

Table E.2 — Single-wall system chimneys

	Corrosion load							
Designation	**Austria**	**Finland**	**France**	**Germany**	**Italy**	**Switzerland**	**UK**	**other countries[h)]**
L 11050		D1	D1			D1		D1
L 11070				D1				
L 11100							D1	
L 11150	D1/W1	W1	W1	W1	D1/W1	W1	W1	W1
L 20040		D1	D2					D1
L 20070							D2[1)]	
L 20100						D2[5)]		
L 30040			D2[2)]					
L 30050								D2[5)]
L 30100		D2[5)]						
L 40040			W1					
L 40050		D2[1)]						D2[1)]
L 40060		W1		D2[1)]		W1	W1	W1
L 40100		D2				D2		
L 50040			D3[4)]/W1					
L 50050								D2
L 50060	D3/W3			D3[4)]/W1	D3			
L 50100		D3[4)]			D3/W1	D3[4)]	D3	D3[4)]
L 60030			D3					
L 60060		W2[1)]		D3			W2[1)]	W2[1)]
L 60100		D3				D3		D3
L 70060				W2[1)]	D3/W2	W2[1)]		

[1)] Without wood

[2)] Without wood in closed fire

[4)] Without wood/oil

[5)] Only for gas and for wood in open fire

[h)] Where a country is not listed it is under column "other countries"

Table E.3 — Rigid metal liners

	Corrosion load									
Designation	**Austria**	**Finland**	**France**	**Germany**	**Italy**	**The Netherlands**	**Spain**	**Sweden**	**Switzerland**	**other countries[h)]**
L 11050		D1	D1			D1	D1		D1	D1
L 11070				D1						
L 11150					D1/W1					
L 12050								D1		
L 12150								W1		
L 13150	D1/W1	W1	W1	W1		W1	W1		W1	W1
L 20xxx[b)]			D2[2)]							
L 20040		D1			D1	D1	D1		D1	D1
L 20050						D2[1)]				
L 30xxx[b)]			D2							
L 30040					D2[5)]		D2[5)]			
L 30050						D2				D2[5)]
L 30060									D2[2)]	
L 30100		D2[5)]								
L 40xxx[b)]			W1							
L 40040					D2[1)]/W1					
L 40050		D2[6)]					D2[1)]			D2[1)]
L 40060		W1		D2[1)]		W1	W1		W1	W1
L 40100										
L 50xxx[b)]			D3/W2[1)]							
L 50040										
L 50050				D2[1)c)]			D3[4)]			D2
L 50060	D3/W3			D3[4)d)]/W1	D3					
L 50100		D3[4)]			D3/W1	D3[4)]			D3[4)]	D3[4)]
L 60060		W2[1)]		D3[d)]		W2[1)]	W2[1)]	D2[1)]	W2[1)]	W2[1)]
L 60100		D3				D3	D3	D2	D3	D3
L 70060					D3/W2					
L 71060								W2[1)]		
L 71100								D3		

[1)] without wood

[2)] without wood in closed fire

[4)] without wood/oil

[5)] only for gas and for wood in open fire

[6)] only for gas and for light oil with sulphur content less then 0,1 %

[b)] only material quality specification is applied

[c)] only for relining

[d)] without insulation only D2

[h)] where a country is not listed it is under column "other countries"

Table E.4 — Flexible metal liners

	Corrosion load									
Designation	**Austria**	**Finland**	**France**	**Germany**	**Italy**	**The Netherlands**	**Sweden**	**Switzer-land**	**UK**	**other countries[h)]**
L 11150					D1/W1					
L 12030		D1	D1				D1	D1		D1
L 20030		D2[1)]/W1	D2[1)]			W1	D2[1)]	D2[1)]	D2[1)]/W1	D2[1)]/W1
L 30010						D2[5)]				
L 40xxx[b)]			D2[1)]/W1							
L 40010		W1				D2[1)]/W1			D2[1)a)]/ W1	D2[1)]/W1
L 40020								D2[1)]/W1		
2 x L 40020			D3[3)]			D3[3)]	D3[3)]		D3[3)]	D3[3)]
L 40040		D2[1)]								
L 40100		D2								
2xL 50xxx[b)]			D3[3)]/ W2[1)]							
2 x L 50010		W2[1)]				D3[3)]/ W2[1)]			W2[1)]	D3[3)]/ W2[1)]
L 50060					D3					
L 50100		D3[3)]			D3/W1					
L 50020								W2[1)]		
L 60010							D2[1)]			
L 60012				D2[1)]						
L 60020							D2			
L 70060					D3/W2					
L 70xxx[b)]			W2[1)]							
L 71010							D3[3)]/ W2[1)]			

[1)] without wood

[3)] without heavy oil and wood/oil

[5)] only for gas and for wood in open fire

[a)] for temperature class higher than T250 only D1

[b)] only material quality specification is applied

[e)] only for pressure class N.

[h)] where a country is not listed it is under column "other countries"

Table E.5 — Connecting flue pipes

	Corrosion load									
Designation	**Austria**	**Finland**	**France**	**Germany**	**Italy**	**The Netherlands**	**Spain**	**Sweden**	**Switzer-land**	**other coun-tries[h]**
L10150				D1[n]						
L 11050		D1	D1			D1	D1		D1	D1
L 11070										
L 11100				D1[n]						
L 11150					D1/W1					
L 12050								D1		
L 12150								W1		
L 13150	D1/W1	W1	W1	D1		W1	W1		W1	W1
L 20xxx[k]			D2[b]							
L 20040		D1				D1	D1		D1	D1
L 20050						D2[a]				
L 20060				D3						
L 30xxx[k]			D2							
L 30040							D2[e]			
L 30050						D2				D2[e]
L 30060									D2[b]	
L 30100		D2[e]								
L 40xxx[k]			W1							
L 40040										
L 40050		D2[i]					D2[a]			D2[a]
L 40060		W1		D3		W1	W1		W1	W1
L 40100										
L 50xxx[k]			D3/W2[a]							
L 50040										
L 50050							D3[d]			D2
L 50060	D3[d l]			D3	D3					
L 50100		D3[d]		D3/W1	D3/W1	D3[d]			D3[d]	D3[d]
L 60060		W2[a]				W2[a]	W2[a]	D2[a]	W2[a]	W2[a]
L 60100		D3				D3	D3	D2	D3	D3
L 70060				D3/W2	D3/W2					
L 71060								W2[a]		
L 71100								D3		
L 80080[m]					D3					

[a] without wood

[b] without wood in closed fire

[c] without heavy oil and wood/oil

[d] without wood/oil

[e] only for gas and for wood in open fire

[h] where a country is not listed, it may choose the column of a of a country or the column "other countries"

[i] only for gas and for light oil with sulphur content less then 0,1 %

[k] only material quality specification is applied

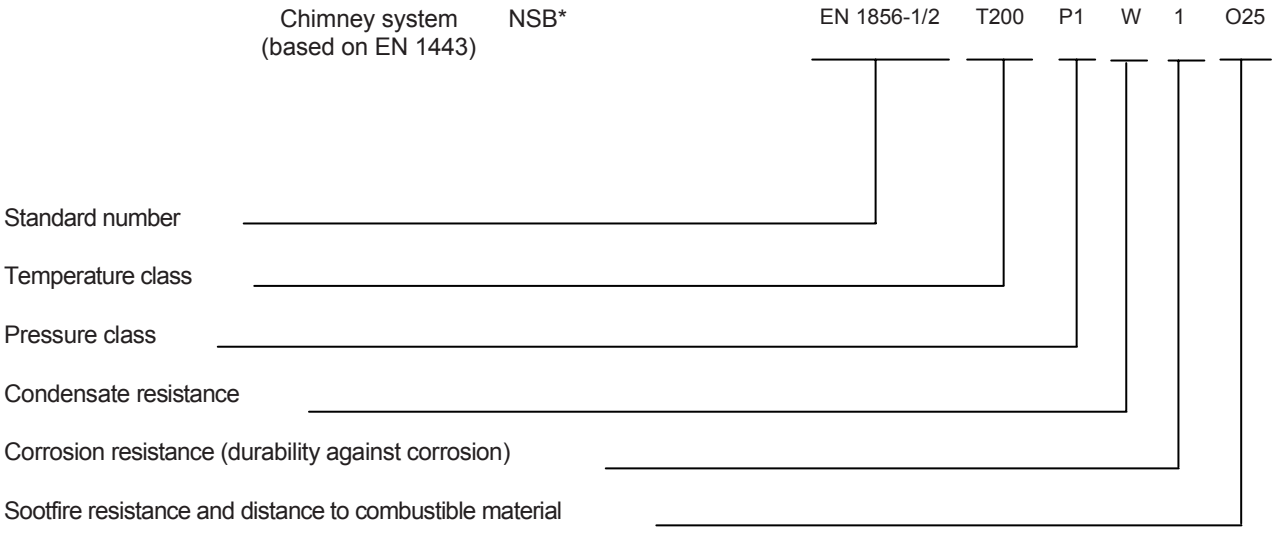
[l] without insulation only D2

[n] for gas with atmospheric burners

[m] double sided vitreous/porcelain enamelled steel (DSVPES)

Annex F
(informative)

Example of chimney system designation for roomsealed applications



Annex G
(informative)

Example for chimney system plate

G.1 Example of a concentric chimney system configuration plate

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Concentric chimney system

Chimney system designation: NSB EN 15287-2 T160 – P1 – W – 1 – O00

Nominal flue duct size:	80 mm
Thermal resistance of flue duct:	0,00 $m^2 \cdot K/W$
Flow resistance of flue:	-
Outer air supply duct size	120 x 120 mm^2
Outer thermal resistance of air supply duct:	0,12 $m^2 \cdot K/W$
Flow resistance of air supply duct:	-

Installer/Address/Tel.:_____

Date of installation: _____

Additional information:
- Chimney system location

G.2 Example of a separate chimney system configuration plate

Warning ! This label must not be covered or be defaced

Separate chimney system

Chimney system designation: NSB EN 15287-2 T160 – P1 – W – 1 – O25

Nominal flue duct size:	80 mm
Thermal resistance of flue duct:	0,40 $m^2 \cdot K/W$
Flow resistance of flue duct:	-
Air supply duct size	80 mm
Flow resistance of air supply duct:	-

Installer/Address/Tel.:_____

Date of installation: _____

Additional information:
- Chimney system location

Annex H
(normative)

Determination of the chimney designation for a completed metal system chimney

H.1 General

The designation of a completed metal system chimney is the same as the designation for the system chimney product except the designation for the corrosion resistance class of metal chimney products. The chimney designation for the corrosion class for these products remains for the time being in accordance with national requirements based on the material specification of the product.

H.2 Corrosion resistance class

The completed chimney shall have the corrosion resistance class 1 where the liner designation according to EN 1856-1, EN 14989-1 and EN 14989-2 is V1, or corrosion resistance class 2 where it is V2, or 3 where it is V3. Where the system chimney product is designated Vm, the chimney shall be designated 1, 2, or 3 according to national regulations prevailing for the material comprising the flue liner.

For member states without regulations in this aspect values could be chosen i.e. from other countries which are listed.

NOTE The materials of the flue liner, included in the designation according to EN 1856-1, may be the subject of National regulation with respect to the corrosion load in the chimney (the combination of condensate resistance and corrosion resistance) and designers are advised to check local regulations with regard to allowed materials having the appropriate specification (material type and thickness). Informative Annex E lists the correlation between the flue liner material specification and corrosion load claimed to exist in the various member states at the time of publication of the standard.

Annex I
(informative)

Example of the determination of the designation of a converted/relined chimney system

I.1 Input data for a typical converted/relined chimney

I.1.1 Existing chimney

Brick 200 mm × 200 mm, wall thickness 115 mm,

distance to combustibles *x* = 50 mm ventilated.

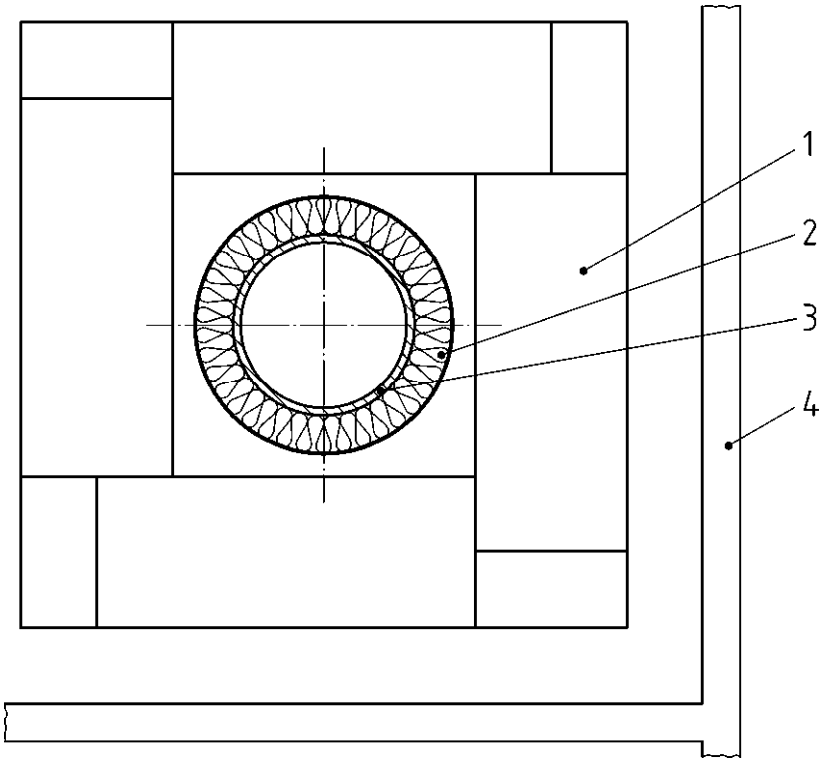
I.1.2 Liner

Metal liner (without insulation) ϕ 105 mm,

designated with T400 - N1 – D - Vm - L 50100 - G.

I.1.3 Insulation

Mineral wool shells declared for a temperature of 950 °C, wall thickness 25 mm.



Key

1 existing chimney
2 insulation
3 liner
4 combustible material

Figure I.1 – Example of components of a converted chimney system

I.2 Temperature class designation

I.2.1 General

The following temperature designation for this converted/relined chimney is obtained according to the method described in A.2 and with the input data of I.2.

I.2.2 Material characteristic

According to A.2 a), first hyphen, the maximum allowed temperature class depending on the characteristic of the materials used is the following:

— liner: designation of the liner ⇒ T400

— insulation: Table A.1 ⇒ T400

— outer wall: Table A.1 ⇒ T600

I.2.3 Fire protection

According to A.2 b), second hyphen, as well as Equation (A.2) (for x ≥ 40 mm) and Equation (A.3) the maximum allowed temperature class for resistance to fire is determined as follows:

$$t_{calc} = \frac{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot}}{\frac{D_h}{D_{haB} \cdot \alpha_a}} \cdot \left(t_{aB} - t_u\right) + t_a \text{, in °C} \qquad \text{(A.2)}$$

where

α_i = 15 W/m²K, α_a = 8 W/m²K, t_{aB} = 100 °C, t_u = 20 °C,

D_h = 0,20 m (because ϕ 105 mm < 0,2 m),

D_{haB} = 0,200 + 2 · 0,115 + (0,200 - 0,105) = 0,525 m

$$\left(\frac{1}{\Lambda}\right)_{tot} = \left(\frac{1}{\Lambda}\right) + \frac{D_h}{D_{ha}} \cdot \left(\frac{1}{\Lambda}\right)_{spB} + \frac{D_h}{D_{hiB}} \cdot \left(\frac{1}{\Lambda}\right)_B \text{ in } \frac{m^2 \cdot K}{W} \qquad \text{(A.3)}$$

with

$$\left(\frac{1}{\Lambda}\right) = y \cdot \sum_n \left[\frac{D_h}{2 \cdot \lambda_n} \cdot \ell n \left(\frac{D_{h,n} + 2 \cdot d_n}{D_{h,n}}\right)\right] \text{ in } \frac{m^2 \cdot K}{W} \qquad \text{(A.4)}$$

with the dimensions of the flue duct:

for the liner: $D_1 = D_h$ = 0,20 m, d1 = 0,001 m

for the insulation: D_2 = 0,20 + 2 · 0,001 = 0,202 m, d_2 = 0,025 m

and the thermal conductivities

for the liner (from Table A.5): $\lambda 1$ = 17 W/(m.K)

— for the insulation (from Table A.4 for mineral wool shell and estimated 300 °C):

λ_2 = 0,102 W/(m ·K)

NOTE The mean temperatures should be calculated iteratively till the estimated values are not less than the calculated values.

$$\Rightarrow \left(\frac{1}{\Lambda}\right) = 1{,}0 \cdot \left[\frac{0{,}20}{2 \cdot 17} \cdot \ell n \left(\frac{0{,}20 + 2 \cdot 0{,}001}{0{,}20}\right) + \frac{0{,}20}{2 \cdot 0{,}102} \cdot \ell n \left(\frac{0{,}202 + 2 \cdot 0{,}025}{0{,}202}\right)\right] = 0{,}217 \frac{m^2}{K \cdot W}$$

and

$\left(\frac{1}{\Lambda}\right)_{spB} = 0$ for an estimated inner surface temperature of the gap of the air supply t_a > 200 °C

and

$$\left(\frac{1}{\Lambda}\right)_{\mathrm{n}} = \mathrm{y} \cdot \frac{D_{\mathrm{h,n}}}{2 \cdot \lambda_n} \cdot \ell\mathrm{n}\left(\frac{D_{\mathrm{h,n}} + 2 \cdot d_{\mathrm{n}}}{D_{\mathrm{h,n}}}\right) \text{ in } \mathrm{m}^2 \cdot \mathrm{K/W} \qquad \text{(A.6)}$$

with

— the dimension for the outer wall: $D_4 = D_{hiB} = (0{,}525 - 2 \,.\, 0{,}115) = 0{,}290$ m, $d_4 = 0{,}115$

— the thermal conductivity for the outer wall (from Table A.5 for bricks with full structure, 1 600 kg/m³ and estimated 200 °C): $\lambda_3 = 0{,}90$ W/(m.K)

$$\Rightarrow \left(\frac{1}{\Lambda}\right)_{\mathrm{B}} = 1{,}1 \cdot \frac{0{,}295}{2 \cdot 0{,}90} \cdot \ell\mathrm{n}\left(\frac{0{,}295 + 2 \cdot 0{,}115}{0{,}295}\right) = 0{,}104 \frac{\mathrm{m}^2 \cdot \mathrm{K}}{\mathrm{W}}$$

$$\Rightarrow \left(\frac{1}{\Lambda}\right)_{\mathrm{tot}} = 0{,}217 + 0 + \frac{0{,}200}{0{,}295} \cdot 0{,}104 = 0{,}288 \frac{\mathrm{m}^2 \cdot \mathrm{K}}{\mathrm{W}}$$

$$\Rightarrow t_{calc} = \frac{\frac{1}{15} + 0{,}288}{\frac{0{,}20}{0{,}525 \cdot 8}} \cdot (100 - 20) + 100 = 696\ ^{\circ}C \qquad \Rightarrow \text{Table A.2} \Rightarrow \text{T450.}$$

I.2.4 Human contact

According to A.2 b), third hyphen, the maximum allowed temperature class for human contact is determined as follows with the maximum allowable outer surface temperature for brick (nearly equal concrete) $t_a = 80$ °C (see Table A.6):

$$t_{\mathrm{calc}} = \frac{\frac{1}{15} + 0{,}288}{\frac{0{,}20}{0{,}525 \cdot 8}} \cdot (80 - 20) + 80 = 527^{\circ}\mathrm{C}$$

$$\Rightarrow \qquad \Rightarrow \qquad \text{Table A.2} \Rightarrow \text{T400.}$$

I.2.5 Determination of temperature class

According to A.2, the temperature class of the relined chimney is the lowest temperature class of I.2.2, I.2.3 and I.2.4:

$\Rightarrow$ Minimum of T400, T450, T400 $\Rightarrow$ T400.

I.2.6 Check of mean temperatures

According to A.2, the mean temperature of the individual walls n can be calculated with Equations (A.11) to (A.15):

$$t_{\mathrm{m},n} = \frac{t_n + t_{n+1}}{2} \text{ in } ^{\circ}\mathrm{C} \qquad \text{(A.11)}$$

with

$$t_1 = t_{calc} - \frac{\frac{1}{\alpha_i}}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_h}{D_{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_{sp} + \left(\frac{1}{\Lambda}\right)_w + \frac{1}{\alpha_{aB}}\right]} \cdot (t_{calc} - t_u) \text{ in °C} \quad \text{(A.14)}$$

and

$$t_{n+1} = t_n - \frac{y \cdot \frac{D_h}{2 \cdot \lambda_n} \cdot \ell n\left(\frac{D_{h,n} + 2 \cdot d_n}{D_{h,n}}\right)}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_h}{D_{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_{sp} + \left(\frac{1}{\Lambda}\right)_w + \frac{1}{\alpha_{aB}}\right]} \cdot (t_{calc} - t_u) \text{ in °C} \quad \text{(A.12)}$$

$$t_{n+1} = t_n - \frac{\frac{D_h}{D_{h,n}} \cdot \left(\frac{1}{\Lambda}\right)_n}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_h}{D_{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_{sp} + \left(\frac{1}{\Lambda}\right)_w + \frac{1}{\alpha_{aB}}\right]} \cdot (t_{calc} - t_u) \text{ in °C} \quad \text{(A.13)}$$

With the values of I.2.3 and t_{calc} = 500 °C for T400 (see Table A.2) and $\left(\frac{1}{\Lambda}\right)_{sp} = 0$ and $\left(\frac{1}{\Lambda}\right)_w = 0$ the surface temperatures are

$$t_i = t_1 = 500 - \frac{\frac{1}{15}}{\frac{1}{15} + 0{,}288 + \frac{0{,}20}{0{,}525} \cdot \left[0 + 0 + \frac{1}{8}\right]} \cdot (500 - 20) = 420°C$$

$$t_2 = 420 - \frac{1{,}0 \cdot \frac{0{,}20}{2 \cdot 17} \cdot 1n\left(\frac{0{,}20 + 2 \cdot 0{,}001}{0{,}20}\right)}{\frac{1}{15} + 0{,}288 + \frac{0{,}20}{0{,}525} \cdot \left[0 + 0 + \frac{1}{8}\right]} \cdot (500 - 20) = 420°C$$

$$t_3 = 420 - \frac{1{,}0 \cdot \frac{0{,}20}{2 \cdot 0{,}102} \cdot 1n\left(\frac{0{,}202 + 2 \cdot 0{,}025}{0{,}202}\right)}{\frac{1}{15} + 0{,}288 + \frac{0{,}20}{0{,}525} \cdot \left[0 + 0 + \frac{1}{8}\right]} \cdot (500 - 20) = 161°C$$

$$t_4 = 161 - \frac{\frac{0{,}20}{0252} \cdot 0}{\frac{1}{15} + 0{,}288 + \frac{0{,}20}{0{,}525} \cdot \left[0 + 0 + \frac{1}{8}\right]} \cdot (500 - 20) = 161°C$$

$$t_5 = 161 - \frac{\frac{0{,}20}{0295} \cdot 0{,}104}{\frac{1}{15} + 0{,}288 + \frac{0{,}20}{0{,}525} \cdot \left[0 + 0 + \frac{1}{8}\right]} \cdot (500 - 20) = 77°C$$

and the mean temperatures

— of the liner: $t_{m,1} = \frac{420 + 420}{2} = 420°C$

— of the insulation: $t_{m,2} = \frac{420 + 161}{2} = 290°C \leq 300\ °C$

— of the outer wall: $t_{m,4} = \frac{148 + 72}{2} = 119°C \leq 200\ °C$

⇒ Estimations were correct.

I.3 Pressure class designation

According to A.4, the resistance to condensate class of the converted/relined chimney is given by the liner designation for resistance to condensate class. For the chimney described in I.1, it is N1.

I.4 Resistance to condensate class designation

According to A.4, the resistance to condensate class of the converted/relined chimney is given by the liner designation for resistance to condensate class. For the chimney described in I.1, it is D.

I.5 Corrosion resistance class designation

According to A.5, the corrosion class of the converted/relined chimney is given by the liner designation for corrosion class. The liner material L 50100 may be used under dry condition for corrosion class "3" (see Table E.3).

I.6 Sootfire resistance class

— The liner is designated as sootfire resistant,

— the insulation is declared for a temperature of 950 °C,

— the outer wall is made according to Table A.7, and

— distance to combustibles is x = 50 mm ventilated.

According to A.6, the chimney can be designated for the sootfire resistance class G.

I.7 Distance to combustible material

The distance to combustible material is given by the distance to combustible material of the existing chimney. For the chimney described in I.1 is given x = 50 mm

⇒ G50.

I.8 Designation of the converted/relined chimney

According to I.2 to I.6 and Annex F, the final designation of the converted/relined chimney, described in I.1, is as follows:

Chimney NSB EN 15287-2 - T400 - N1 - D - 3 - G50

I.9 Chimney plate of the converted/relined chimney in this annex

WARNING! — This label shall not be covered or be defaced

Chimney

Any Co., Any Street, Any City

Concentric chimney system: NSB EN 15287-2 -T400 – N1 - D - 3 – G50

Nominal size:	105 mm
Thermal resistance:	0,217 m^2K/W
Flow resistance of flue:	-
Outer air supply duct size	200 x 200 mm^2
Outer thermal resistance of air supply duct:	0,104 $m^2 \cdot K/W$
Flow resistance of air supply duct:	-

- **Installer/Address/Tel.:** Mustermann, Musterstr., 99999 Musterstadt /99999-0000000

- **Date of installation:** 2007-05-02

Annex J
(informative)

Example for the determination of the designation of a custom built chimney system

J.1 Input data for a custom-built chimney system

J.1.1 Liner

Clay/ceramic liner (without insulation), wall thickness 8 mm, ∅ 100 mm, designated with B2N1.

With Table D.1 the relevant designation of this clay ceramic liner according to EN 1443 is T400 N1 D 3 O or T400 N1 W 2 O.

J.1.2 Insulation

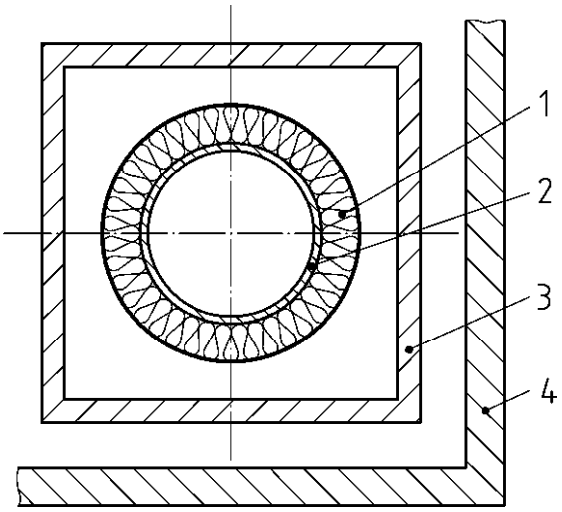
Mineral wool declared for a temperature of 910 °C and a thermal resistance of 0,30 (m² · K)/W, wall thickness 20 mm.

J.1.3 Air supply duct

Concrete 200 mm x 200 mm, wall thickness 100 mm, $(1/\Lambda)_B$ = 0,1 m²K/W.

J.1.4 Combustible wall

Wood, $(1/\Lambda)_w$ = 0,14 m²K/W, distance to air supply duct x = 20 mm.



Key

1 liner
2 insulation
3 air supply duct
4 combustible wall

Figure J.1 – Example of components of a custom-built chimney

J.2 Temperature class designation

J.2.1 General

The temperature designation for this custom-built chimney is determined according to the method described in A.2 and with the input data of I.1.

J.2.2 Material characteristic

According to A.2 a), first hyphen, the maximum allowed temperature class depending on the characteristic of the materials used is as follows:

— liner: designation of the liner $\Rightarrow$ T400

— insulation: Table A.1 $\Rightarrow$ T400

$\Rightarrow$ T400

J.2.3 Resistance to fire

According to A.2 b), second hyphen, as well as Equation (A.1) and Equation (A.4) given in Annex A, the maximum allowed temperature class for resistance to fire is determined as follows:

$$t_{calc} = \frac{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_h}{D_{haB}} \cdot \left(\frac{1}{\Lambda}\right)_{sp}}{\frac{D_h}{D_{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_w + \frac{1}{\alpha_a}\right]} \cdot (t_c - t_u) + t_c \text{, in °C} \qquad \text{(A.1)}$$

where

α_i = 15 W/m²K, α_a = 8 W/m²K, t_c = 85 °C, t_u = 20 °C

D_h = 0,20 m (because ϕ 100 mm < 0,2 m)

D_{haB} = 0,200 + 2 · 0,100 + (0,200 – 0,100) = 0,50 m

$$\left(\frac{1}{\Lambda}\right)_{tot} = \left(\frac{1}{\Lambda}\right) + \frac{D_h}{D_{ha}} \cdot \left(\frac{1}{\Lambda}\right)_{spB} + \frac{D_h}{D_{hiB}} \cdot \left(\frac{1}{\Lambda}\right)_B \text{ in } \frac{m^2 \cdot K}{W} \quad (A.3)$$

with

$$\left(\frac{1}{\Lambda}\right) = D_h \cdot \sum_n \left[\left(\frac{1}{\Lambda}\right)_n \cdot \frac{1}{D_{h,n}}\right] \text{ in } \frac{m^2 \cdot K}{W} \quad (A.5)$$

with the dimensions of the flue duct:

— for the liner: $D_1 = D_h = 0,20$ m, $d_1 = 0,008$ m

— for the insulation: $D_2 = 0,20 + 2 \cdot 0,008 = 0,216$ m, $d_2 = 0,020$ m

and the thermal resistance

liner: (without insulation) $\Rightarrow \quad \left(\frac{1}{\Lambda}\right)_1 = 0,00 \frac{m^2 \cdot K}{W}$

insulation: (declared value) $\Rightarrow \quad \left(\frac{1}{\Lambda}\right)_2 = 0,30 \frac{m^2 \cdot K}{W}$

$$\Rightarrow \left(\frac{1}{\Lambda}\right) = 0,20 \cdot \left(\frac{0}{0,20} + \frac{0,30}{0,216}\right) = 0,278 \frac{m^2 \cdot K}{W}$$

$$\left(\frac{1}{\Lambda}\right)_{spB} = 0,1165 - 0,000488 \cdot t_a + 0,00000065 \cdot t_a^2 + \left(4,36 - 0,0351 \cdot t_a + 0,000082 \cdot t_a^2\right) \cdot d_{spB} - \left(58 - 0,46 \cdot t_a + 0,0011 \cdot t_a^2\right) \cdot d_{spB}^2 \text{ in m²·K/W} \quad (A.6)$$

with the dimensions for the gap of the air supply

— diameter of the inner surface: $D_{ha} = 0, 216 + 2 \,.\, 0,020 = 0,256$ m

— diameter of the outer surface: $D_{hiB} = 0,500 – 2 \,.\, 0,100 = 0,300$ m

— width $d_{spB} = \frac{0,300 - 0,256}{2} = 0,022$ m

and the estimated inner surface temperature of the gap of the air supply t_a = 200 °C

$$\Rightarrow \left(\frac{1}{\Lambda}\right)_{spB} = 0,1165 - 0,000488 \cdot 200 + 0,00000065 \cdot 200^2 + \left(4,36 - 0,0351 \cdot 200 + 0,000082 \cdot 200^2\right) \cdot 0,022 - \left(58 - 0,46 \cdot 200 + 0,0011 \cdot 200^2\right) \cdot 0,022^2$$

$$= 0{,}054\,\frac{\mathrm{m}^2 \cdot \mathrm{K}}{\mathrm{W}}$$

$$\Rightarrow \left(\frac{1}{\Lambda}\right)_{\mathrm{tot}} = 0{,}278 + \frac{0{,}200}{0{,}246} \cdot 0{,}054 + \frac{0{,}200}{0{,}300} \cdot 0{,}100 = 0{,}389\,\frac{\mathrm{m}^2 \cdot \mathrm{K}}{\mathrm{W}}$$

and

$$\left(\frac{1}{\Lambda}\right)_{\mathrm{sp}} = 0{,}1165 - 0{,}000488 \cdot t_{\mathrm{a}} + 0{,}00000065 \cdot t_{\mathrm{a}}^2 + \left(4{,}36 - 0{,}0351 \cdot t_{\mathrm{a}} + 0{,}000082 \cdot t_{\mathrm{a}}^2\right) \cdot x - \left(58 - 0{,}46 \cdot t_{\mathrm{a}} + 0{,}0011 \cdot t_{\mathrm{a}}^2\right) \cdot x^2 \quad \text{in } \frac{\mathrm{m}^2 \cdot \mathrm{K}}{\mathrm{W}} \qquad \text{(A.7)}$$

where

t_{a} = 150 °C (estimated), x = 0,02 m

$$\Rightarrow \left(\frac{1}{\Lambda}\right)_{\mathrm{sp}} = 0{,}1165 - 0{,}000488 \cdot 100 + 0{,}00000065 \cdot 150^2 + \left(4{,}36 - 0{,}0351 \cdot 150 + 0{,}000082 \cdot 150^2\right) \cdot 0{,}02 - \left(58 - 0{,}46 \cdot 150 + 0{,}0011 \cdot 150^2\right) \cdot 0{,}02^2$$

$$= 0{,}071\,\frac{\mathrm{m}^2 \cdot \mathrm{K}}{\mathrm{W}}$$

$$\Rightarrow t_{\mathrm{calc}} = \frac{\frac{1}{15} + 0{,}389 + \frac{0{,}200}{0{,}500} \cdot 0{,}071}{\frac{0{,}200}{0{,}500} \cdot \left[0{,}14 + \frac{1}{8}\right]} \cdot (85 - 20) + 85 = 381\,^{\circ}\mathrm{C} \Rightarrow$$ Table A.2 ⇒ T300.

J.2.4 Human contact

According to A.2 b), third hyphen, the maximum allowed temperature class for human contact is determined as follows with the maximum allowable outer surface temperature for brick (nearly equal concrete) t_a = 80 °C (see Table A.6):

$$\Rightarrow t_{\mathrm{calc}} = \frac{\frac{1}{15} + 0{,}389}{\frac{0{,}20}{0{,}480 \cdot 8}} \cdot (80 - 20) + 80 = 605\,^{\circ}\mathrm{C} \Rightarrow$$ Table A.2 ⇒ T450.

J.2.5 Determination of temperature class

According to A.2, the temperature class of the custom built chimney is the lowest temperature class of J.2.2, J.2.3 and J.2.4:

⇒ Minimum of T400, T300, T450 ⇒ T300.

J.2.6 Check of mean temperatures

According to A.2, the mean temperature of the individual walls n can be calculated with Equations (A.11) to (A.15):

$$t_{m,n} = \frac{t_n + t_{n+1}}{2} \text{ in °C} \quad \text{(A.11)}$$

with

$$t_1 = t_{calc} - \frac{\frac{1}{\alpha_i}}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_h}{D_{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_{sp} + \left(\frac{1}{\Lambda}\right)_w + \frac{1}{\alpha_{aB}}\right]} \cdot \left(t_{calc} - t_u\right) \text{ in °C} \quad \text{(A.14)}$$

and

$$t_{n+1} = t_n - \frac{y \cdot \frac{D_h}{2 \cdot \lambda_n} \cdot \ln\left(\frac{D_{h,n} + 2 \cdot d_n}{D_{h,n}}\right)}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_h}{D_{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_{sp} + \left(\frac{1}{\Lambda}\right)_w + \frac{1}{\alpha_{aB}}\right]} \cdot \left(t_{calc} - t_u\right) \text{ in °C} \quad \text{(A.12)}$$

$$t_{n+1} = t_n - \frac{\frac{D_h}{D_{h,n}} \cdot \left(\frac{1}{\Lambda}\right)_n}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right)_{tot} + \frac{D_h}{D_{haB}} \cdot \left[\left(\frac{1}{\Lambda}\right)_{sp} + \left(\frac{1}{\Lambda}\right)_w + \frac{1}{\alpha_{aB}}\right]} \cdot \left(t_{calc} - t_u\right) \text{ in °C} \quad \text{(A.13)}$$

With the values of J.2.3 and t_{calc} = 350 °C for T300 (see Table A.2) and $\left(\frac{1}{\Lambda}\right)_{sp} = 0{,}098 \frac{m^2 \cdot K}{W}$ and $\left(\frac{1}{\Lambda}\right)_{sp} = 0{,}071 \frac{m^2 \cdot K}{W}$ and $\left(\frac{1}{\Lambda}\right)_w = 0{,}14 \frac{m^2 \cdot K}{W}$ the surface temperatures are:

$$t_i = t_1 = 350 - \frac{\frac{1}{15}}{\frac{1}{15} + 0{,}389 + \frac{0{,}200}{0{,}500} \cdot \left[0{,}071 + 0{,}14 + \frac{1}{8}\right]} \cdot (350 - 20) = 313°C$$

$$t_2 = 313 - \frac{\frac{0{,}200}{0{,}200} \cdot 0}{\frac{1}{15} + 0{,}389 + \frac{0{,}200}{0{,}500} \cdot \left[0{,}071 + 0{,}14 + \frac{1}{8}\right]} \cdot (350 - 20) = 313°C$$

$$t_3 = 313 - \frac{\frac{0{,}200}{0{,}216} \cdot 0{,}25}{\frac{1}{15} + 0{,}389 + \frac{0{,}200}{0{,}500} \cdot \left[0{,}071 + 0{,}14 + \frac{1}{8}\right]} \cdot (350 - 20) = 184°C$$

$$t_4 = 184 - \frac{\frac{0{,}200}{0256} \cdot 0{,}054}{\frac{1}{15} + 0{,}389 + \frac{0{,}200}{0{,}500} \cdot \left[0{,}071 + 0{,}14 + \frac{1}{8} \right]} \cdot (350 - 20) = 160°C$$

$$t_5 = 160 - \frac{\frac{0{,}200}{0{,}300} \cdot 0{,}1}{\frac{1}{15} + 0{,}389 + \frac{0{,}200}{0{,}500} \cdot \left[0{,}071 + 0{,}14 + \frac{1}{8} \right]} \cdot (350 - 20) = 123°C$$

and the temperatures of the outer surfaces:

— of the flue duct: $t_a = t_3 = 184$ °C ≤ 200 °C

of the air supply duct: $t_{aB} = t_5 = 123$ °C ≤ 150 °C

⇒ Estimations were correct.

J.3 Pressure class designation

According to A.3, the pressure class of the custom-built chimney is given by the liner designation for pressure class. For the chimney described in J.1, it is N1.

J.4 Resistance to condensate class designation

According to A.4, the resistance to condensate class of the custom-built chimney is given by the liner designation for resistance to condensate class. For the chimney described in J.1, D or W is possible.

J.5 Corrosion resistance class designation

According to A.5, the corrosion class of the custom-built chimney is given by the liner designation for corrosion class. For the liner described in J.1, 3 for the condensate class D or 2 for the condensate class W is possible.

J.6 Sootfire resistance class

Because the outer wall is neither a product e.g. to EN 12446, designated at least T400 and G nor made according to Table A.7 the chimney is not sootfire resistance and has therefore, according to A.6, to be designated for the sootfire resistance class O.

J.7 Distance to combustible material

According to A.6, the distance to combustible material is given by the distance to the enclosure of combustible material. For the chimney described in I.1 is given $x = 20$ mm:

⇒ O20.

J.8 Designation of the custom-built chimney

According to J.2 to J.6 and Annex F, the final designation of the custom-built chimney, described in J.1, is as follows:

Chimney NSB EN 15287-2 - T200 - N1 - D - 3 - O20

or Chimney NSB EN 15287-2 - T200 - N1 - W - 2 - O20

J.9 Chimney plate for the custom-built chimney in this annex

WARNING! — This label shall not be covered or be defaced

Chimney

Any Co., Any Street, Any City

Concentric chimney system:	NSB EN15287-2	T300 - N1 - D - 3 - O20
	or	T300 - N1 - W - 2 - O20

Nominal size:	100 mm
Thermal resistance:	0,28 m^2K/W
Flow resistance of flue:	-
Outer air supply duct size	200 x 200 mm^2
Outer thermal resistance of air supply duct:	0,10 $m^2 \cdot K/W$
Flow resistance of air supply duct:	-

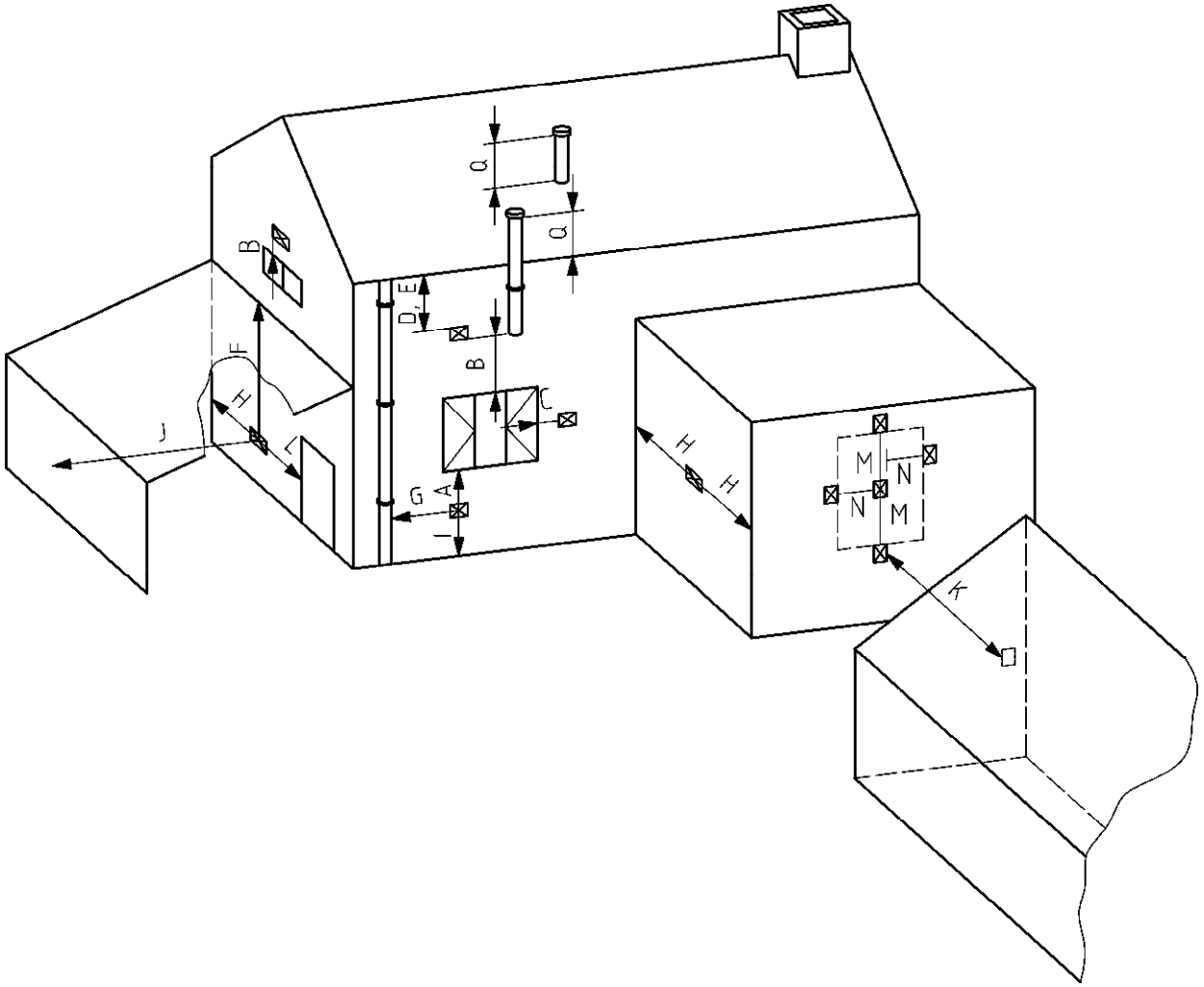
- **Installer/Address/Tel**.: Mustermann, Musterstr., 99999 Musterstadt /99999-0000000

- **Date of installation:** 2007-06-22

Annex K
(informative)

Location of outlets of chimney systems

Figure K.1 gives an example of chimney outlet positions for residential heating or comparable applications, which has been developed on the basis of typical known national rules. Table K.1 contains recommended dimensions, also based on known national rules, for the location of chimney outlets.



Key
See Table K.1

Figure K.1 — Example of the location of outlets of balanced flue chimney configurations

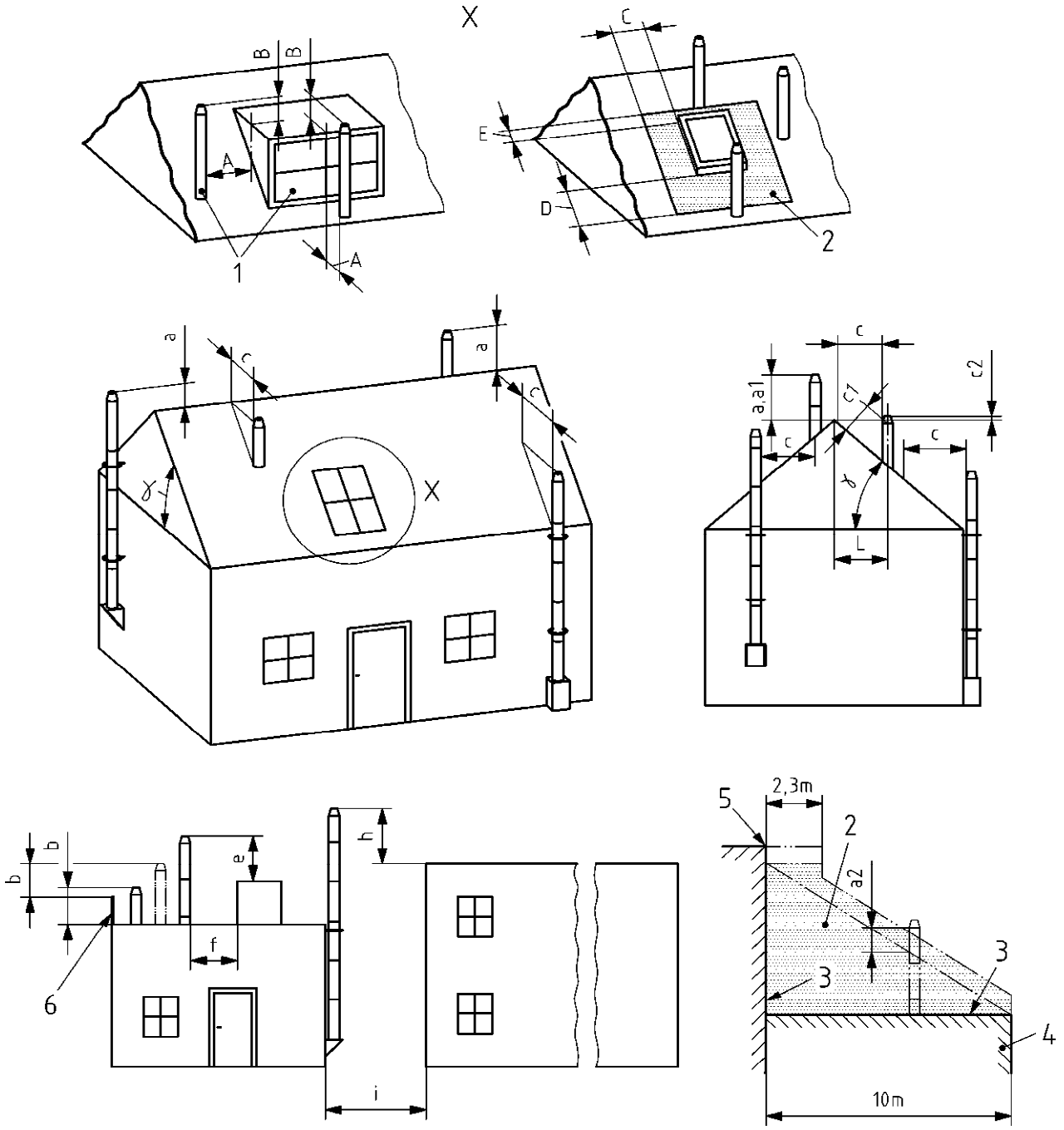
Table K.1 — Recommended dimensions for the location of outlets of balanced flue chimney configurations for gas (see Figure K.1)

symbol	**terminal position**	**heat input** kW (net)	**natural draught** mm	**fanned draught** mm
A [a]	directly below an opening, air brick, opening window, etc	0 to 7 > 7 to 14 > 14 to 32 > 32 to 70	300 600 1500 2000	300
B [a]	above an opening, air brick, opening window, etc	0 to 7 > 7 to14 >14 to 32 >32 to 70	300 300 300 600	300
C [a]	horizontally to an opening, air brick, opening window, etc	0 to 7 > 7 to 14 > 14 to 32 > 32 to 70	300 400 600 600	300
D	below temperature sensitive building components, e.g. plastic gutters, soil pipes or drain pipes	up to 70	300	75
E	below eaves	up to 70	300	200
F	below balconies or car port roof	up to 70	600	200
G	from a vertical drain pipe or soil pipe	0 to 5 > 5 to 70	300 300	75 150
H[b]	from an internal or external corner	up to 70	600	300
I	above ground, roof or balcony level	up to 70	300	300
J	from a surface facing the terminal	up to 70	600	600
K	from a terminal facing a terminal	up to 70	600	1200
L	from an opening in a car port (e.g. door, window) into the dwelling	up to 70	1200	1200
M	vertically from a terminal on the same wall	up to 70	1500	1500
N	horizontally from a terminal on the same wall	up to 70	300	300
Q	above intersection with roof: top of terminal below ridge level[c] top of terminal above ridge level	up to 70	300 300	300 300

[a] in addition, the terminal should not be nearer than 150 mm (fanned draught) or 300 mm (natural draught) to an opening in the building fabric formed for the purpose of accommodating a built-in element such as a window frame.

[b] for external corners this restriction can be ignored where the external corner is formed by a building protrusion less than 450 mm, (for example, chimneys on external walls) for fanned draught chimney system outlets; for natural draught chimney system outlets when connected to a natural draught appliance not exceeding a net input of 7 kW; and if permitted by the appliance manufacturer's installation instructions.

[c] horizontal distance from surface of pitched roof should not exceed 300 mm.



Key

1 terminal location adjacent to windows and openings on pitched roof

2 prohibited zone

3 these walls may be part of same buildings or be part of adjacent buildings

4 edge of lower structure of flat roof extension or 10 m along from structure whichever is the greatest

5 top of adjacent higher building

6 parapet

A distance to structures, windows and openings on a pitched roof

B height above openings in a distance A

C distance aside from openings or windows on a pitched roof

D distance below openings or windows on a pitched roof

E distance above openings or windows on a pitched roof

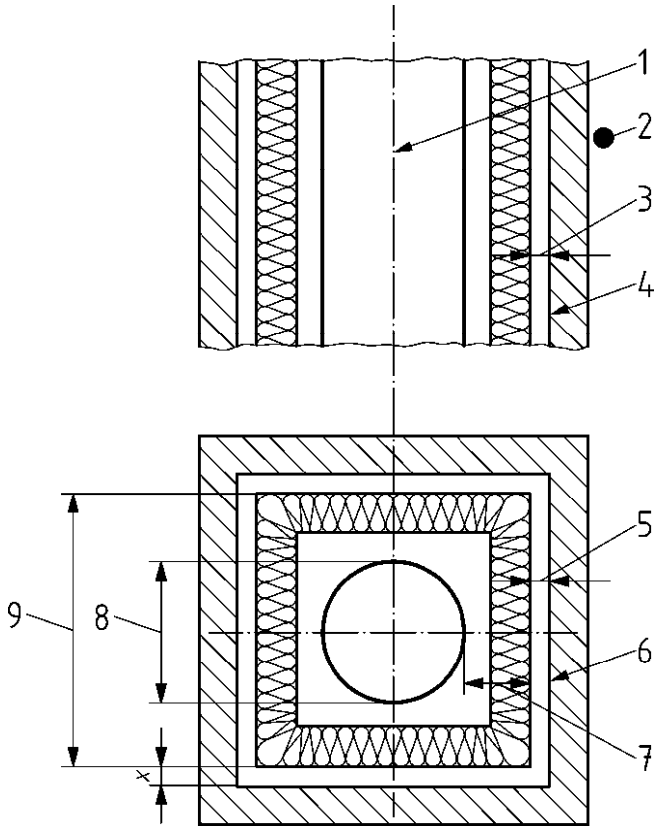
Figure K.2 — Example of the location of outlets of non balanced flue chimney configurations

Table K.2 — Recommended dimensions for the location of outlets of non balanced flue chimney configurations (see Figure K.2)

		Recommended dimensions for the location of chimney outlets of			
Symbol	**Location of chimney outlets**	**Solid fuel applications**	**Oil applications**	**Gas applications (natural draught)**	**Positive pressure applications (fanned flue)**
a	height above ridge of pitched roof close to ridge	a ≥ 0,4 m	a ≥ 0,4 m	a ≥ 0,4 m	≥ 0,3 m
a1	height above ridge of a thatched pitched roof close to ridge	a ≥ 0,8 m	a ≥ 0,8 m	a ≥ 0,6 m	a ≥ 0,3 m
a2	height above line between adjacent buildings or structures	≥ 0,6 m	≥ 0,6 m	≥ 0,6 m	≥ 0,6 m
b	height above flat roofs or closed parapets	b ≥ 1,0 m	b ≥ 1,0 m	b ≥ 0,6 m	≥ 0,3 m
γ	angle of inclination of the roof NOTE A roof is considered flat if γ ≤ 20° and pitched if γ > 20°.				
c	horizontal distance from the pitched roof	c ≥ 2,3 m	c ≥ 2,3 m	c ≥ 1,5 m	c ≥ 1,5 m
c2 where l	height above pitched roof distance from the ridge of the roof	≥ 0,4 m if l < 8 m	≥ 0,4 m if l < 8 m	≥ 0,4 m if l <1.5 m	≥ 0,4 m if l < 1.5 m
e	height above obstacles or structure on a flat roof	if f < 1,5xg	if f < 1,5xg	if f < 1,5xg	if f < 1,5xg
where f	distance of the chimney to obstacles or structure	then	then	then	then
h	height above adjacent or adjoining buildings	if i < 1,5xj	if i < 1,5xj	if i < 1,5xj	if i < 1,5xj
where i	horizontal distance of the chimney to adjacent or adjoining buildings	then h ≥ 1,0 m	then h ≥ 1,0 m	then h ≥ 0,6 m	then h ≥ 0,6 m
A	distance to structures with windows and openings on a pitched roof	If below ridge or a < 2,3 m then B ≥ 1 m	If A < 1,5m then B ≥ 0,6m	If A < 1,5m then B ≥ 0,6m	If A < 1,5m then B ≥ 0,6m
B	height above structures with windows or openings on a pitched roof				
C	distance at the side of openings or windows on a pitched roof	C ≥ 1,0 m	C ≥ 1,0 m	C ≥ 0,6 m	C ≥ 0,6 m
D	distance below openings or windows on a pitched roof	D ≥ 2 m	D ≥ 2 m	D ≥ 2 m	D ≥ 2 m
E	Distance above openings or windows on a pitched roof	E ≥ 1,0 m	E ≥ 1,0 m	E ≥ 0,6 m	E ≥ 0,6 m

Annex L
(informative)

Method for calculating the temperature of adjacent materials



Key

1 t_{calc}
2 t_c
3 $(1/\Lambda)_{sp}$
4 t_u
5 $(1/\Lambda)_{sp}$
6 t_u
7 $(1/\Lambda)$
8 D_{ni}
9 D_{ha}

Figure L.1 – Example of chimney system with weather systems

L.1 Method for the calculation of the temperature of adjacent materials

The following Equation (L.1) may be used for a known value of $(1/\Lambda)_{wp}$:

$$t_{wp} = t_f - \frac{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right) + \frac{D_h}{D_{ha}} \cdot \left(\frac{1}{\Lambda}\right)_{spB} + \frac{D_h}{D_{hiB}} \cdot \left(\frac{1}{\Lambda}\right)_B + \frac{D_h}{D_{haB}} \cdot \left(\frac{1}{\Lambda}\right)_{sp}}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right) + \frac{D_h}{D_{ha}} \cdot \left(\frac{1}{\Lambda}\right)_{spB} + \frac{D_h}{D_{hiB}} \cdot \left(\frac{1}{\Lambda}\right)_B + \frac{D_h}{D_{haB}} \cdot \left(\frac{1}{\Lambda}\right)_{sp} + \frac{D_h}{D_{haB} + 2 \cdot x} \cdot \left(\frac{1}{\Lambda}\right)_{wp} + \frac{D_h}{(D_{haB} + 2 \cdot x + 2 \cdot d_{wp}) \cdot \alpha_a}} (t_f - t_u) \text{ in °C} \quad \text{(L.1)}$$

t_{wp}	is the calculated temperature of the weatherproofing	in °C
t_f	is the relevant flue gas temperature	in °C
x	is the distance from the outer surface of the chimney to the surface of the weatherproofing	in m
α_i	is the internal coefficient of heat transfer	in W/(m².K)
α_a	is the external coefficient of heat transfer	in W/(m².K)
$(1/\Lambda)$	is the thermal resistance of the flue duct	in m².K/W
D_{ha}	is the outer diameter of the flue duct	in m
D_h	is the inner diameter of the chimney (liner)	in m
$(1/\Lambda)_{spB}$	is the thermal resistance of the ventilated air gap	in m².K/W
D_{hiB}	is the inner diameter of the air duct	in m
$(1/\Lambda)_B$	is the thermal resistance of the air supply duct	in m².K/W
$(1/\Lambda)_{sp}$	is the thermal resistance of the space between chimney system and adjacent combustible materials	in m².K/W
$(1/\Lambda)_w$	is the thermal resistance of the adjacent wall with a combustible inner surface	in m².K/W
d_{wp}	is the wall thickness of the weatherproofing	in m
D_{haB}	is the outer diameter of the chimney system	in m
t_u	is the ambient temperature	in °C

Equation (L.2) may be used for a naturally ventilated space x with at least 40 mm to combustible materials.

$$t_{wp} = t_f - \frac{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right) + \frac{D_h}{D_{ha}} \cdot \left(\frac{1}{\Lambda}\right)_{spB} + \frac{D_h}{D_{hiB}} \cdot \left(\frac{1}{\Lambda}\right)_B}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right) + \frac{D_h}{D_{ha}} \cdot \left(\frac{1}{\Lambda}\right)_{spB} + \frac{D_h}{D_{hiB}} \cdot \left(\frac{1}{\Lambda}\right)_B + \frac{D_h}{D_{haB} \cdot \alpha_a} \cdot} \cdot (t_f - t_u) - \Delta t_a \text{ in °C} \quad \text{(L.2)}$$

where

Δt_a	is the temperature difference between outer surface of the chimney and the inner surface of the weatherproofing	in K

Typical values for the internal and external coefficient of heat transfer are:

α_i = 15 W/(m².K)

α_a = 8 W/(m².K)

and for the temperatures:

t_u = 20 °C

Δt_a = 15 K (from experience) for at least 40 mm distance

L.2 Example for calculation of the temperature of adjacent materials

Input data of the chimney system (see Annex A):

— inner diameter of the chimney (liner) D_h = 0,105 m

— outer diameter of the flue duct D_{ha} = 0,157 m

— diameter of the air duct D_{hiB} = 0,2 m

— outer diameter of the air duct D_{haB} = 0,43 m

— width of the ventilated air gap d_{spB} = 0,0215 m.

Annex A, Table A.3 for 200 °C and d_{spB} = 20 and 25 mm:

— thermal resistance of the ventilated air gap (air supply duct) $(1/\Lambda)_{spB}$ = 0,055 m²K/W

Designation: Chimney EN 15287-2 - T400 – N1 –D – 3 – G50

— relevant flue gas temperature t_f = 400 °C,

— thermal resistance of the chimney $(1/\Lambda)$ = 0,217 m²K/W

— thermal resistance of the air supply duct $(1/\Lambda)_B$ = 0,104 m²K/W

Input data of the weatherproofing:

— thermal resistance of the weatherproofing: $(1/\Lambda)$wp = 0,1 m2K/W,

— wall thickness of the weatherproofing d_{wp} = 0,01 m,

— distance from the outer surface of the chimney to the surface of the weatherproofing x = 0,02 m.

Annex A, Table A.3 for 100 °C and x = 20 mm:

— thermal resistance of the space between chimney system and weatherproofing: $(1/\Lambda)_{sp}$ = 0,101 m2K/W

According to Equation (L.1) the temperature of adjacent material is determined as follows:

$$t_{wp} = 500 - \frac{\frac{1}{15} + 0{,}217 + \frac{0{,}105}{0{,}157}\cdot 0{,}055 + \frac{0{,}105}{0{,}2}\cdot 0{,}104 + \frac{0{,}105}{0{,}43}\cdot 0{,}101}{\frac{1}{15} + 0{,}217 + \frac{0{,}105}{0{,}157}\cdot 0{,}055 + \frac{0{,}105}{0{,}2}\cdot 0{,}104 + \frac{0{,}105}{0{,}43}\cdot 0{,}101 + \frac{0{,}105}{0{,}43 + 2\cdot 0{,}02}\cdot 0{,}1 + \frac{0{,}105}{(0{,}43 + 2\cdot 0{,}02 + 2\cdot 0{,}01)\cdot 8}} \cdot (500 - 20) = 72{,}5°C$$

According to Equation (L.2) for a naturally ventilated space with at least 40 mm to weatherproofing the temperature of the adjacent material is determined as follows:

$$t_{wp} = 500 - \frac{\frac{1}{15} + 0{,}217 + \frac{0{,}105}{0{,}157} \cdot 0{,}055 + \frac{0{,}105}{0{,}2} \cdot 0{,}104}{\frac{1}{15} + 0{,}217 + \frac{0{,}105}{0{,}157} \cdot 0{,}055 + \frac{0{,}105}{0{,}2} \cdot 0{,}104 + \frac{0{,}105}{0{,}43 \cdot 8}} \cdot (500 - 20) - 15 = 41\,^{\circ}\mathrm{C}$$

Annex M
(informative)

Checking, handling and site storage of materials and components

M.1 General

The installation design and the product manufacturer's installation instructions should be available and should be followed.

NOTE It is recommended that the installation is done only by a competent installer.

M.2 Checking, handling and site storage of materials and components

M.2.1 Checking on delivery of materials

Before installation, delivery tickets and certificates should be checked against the design specification.

The condition of materials and components when received should be examined.

Any product which is damaged or not as specified, should be rejected.

M.2.2 Checking before installation

The installer should check that all components required to complete the installation are available.

M.2.3 Check of existing chimney

Any repair of the existing chimney should be undertaken so that the designation for the relined or converted chimney can be achieved. Repair of the existing chimney should be undertaken before relined or converted. Any repair should ensure that the required resistance to fire of the relined or converted chimney can be achieved (see 4.2.3).

NOTE The resistance to fire (external to external) of a chimney installation is subject to the work of CEN/TC 127.

When relining an existing chimney the flue should be clean and free of obstacles.

Any remedial work to ensure the structural stability should be undertaken.

The existing chimney should be checked for its size suitability and its gas tightness established.

Establish the resistance to fire criteria for the existing chimney.

M.2.4 Site handling and storage

The sections and fittings should be handled in such a manner as to prevent breakage and deterioration and to keep their characteristics.

Components should be stored in their original packaging in a clean, dry area in accordance with the manufacturer's instructions.

M.2.5 Coordination of work

The installer should liaise with the contractor to ensure that access to the chimney route is available and that sufficient time is allowed for fixing the liner and co-operation with other trades is arranged.

NOTE The installer should check that all conduits, pipes, electrical cables, electrical boxes, etc. that affect the chimney route have been suitably located.

If the design requires structural alteration, such as joists, this work should be arranged to be undertaken.

Annex N
(informative)

Chimney commissioning

N.1 General

After finishing the chimney installation and before starting the heating appliance operation two types of checks are prescribed, physical inspection and a check on the operational capability.

If the physical checks are satisfactory, then the flue integrity can be demonstrated by one or more of the operational checks.

N.2 Physical checks

The physical checks should demonstrate:

1) that the installation is according to the design,
2) that the manufacturer's installation instructions have been followed,
3) that the flue route is in accordance with the design,
4) that the chimney plate correctly describes the chimney,
5) that the designation of the chimney matches the performance of the heating appliance,
6) that components have not been damaged during installation,
7) that the connecting flue pipe and adapters between the heating appliance and the chimney are fitted correctly,
8) that the distance between the connecting flue pipe and combustible material is in accordance with 4.3.8.3.2,
9) that correct distances of the chimney from combustible materials have been achieved,
10) that any fire stop, spacer and ceiling support is correctly installed,
11) that openings for testing, cleaning and maintenance are accessible,
12) that all accessories are installed correctly,
13) that all components, joints, connections, locking bands, etc. are securely installed,
14) that components for weatherproofing have been installed correctly,
15) that access to the top of the chimney meets local regulations,
16) that the location of chimney outlets is in accordance with 4.3.18,

17) that any spaces where the chimney passes through floors, ceilings or walls, is clear of any extraneous matter, gas, water or electrical services,

18) that back ventilation is in accordance with 4.3.1,

19) that the flue and back ventilation is clear of obstructions, e.g. jointing material, and the cross section is maintained throughout the whole length.

NOTE This may be achieved by one of the following appropriate methods:
1) passing a gauge through the flue,
2) inspection with a camera or a mirror.

20) that no external elements have been attached to the chimney, e.g. aerials, clothes lines, flags, which affects the structural stability or performance or cleaning capability,

21) that any lightning protection has been correctly installed,

For relined or converted chimneys the following additional checks should be made

22) that any openings made in the existing chimney are closed,

23) that the gap between the liner and the existing chimney is clear of all extraneous matter.

N.3 Operational checks

N.3.1 Flue flow test

Carry out a flow visualisation test using a smoke match at the position intended for the heating appliance. If there is no spillage of smoke into the room, then the test should be continued using a smoke pellet.

However, if there is smoke spillage then the flue should be heated using a blow torch or other means. The flow visualisation test should now be repeated. If there is still smoke spillage then there are problems which have to be rectified. If there is no smoke spillage, then the test should be continued using a smoke pellet.

The test is satisfactory if, while the smoke pellet is burning, there is no spillage of smoke at the heating appliance position, no seepage of smoke over the length of the flue and there is discharge of smoke only from the correct terminal.

However, if there is smoke spillage at the heating appliance position, or seepage from the chimney, or discharge from two or more terminals, then the test has failed. The heating appliance has not to be installed until the faults have been found, rectified and a repeat check satisfactorily completed.

N.3.2 Smoke test

The heating appliance, if fitted, should not be operating at the time of test.

Method A:

All openings should be closed. At the chimney entrance or any lower access point, fit a fan to the chimney regulated for ventilation with a pressure of 0,2 Pa/m for chimney with a maximum length of 10 m or 2 Pa for a chimney with a length greater than 10 m. A manometer has to be installed directly to the flue. At the chimney top a flow tube is installed to control the smoke flow, so that the chimney is full of smoke.

Smoke is produced with a specified oil-burner in the chamber with the fan in front of the chimney entrance.

An alternative method is:

Method B:

Before commencing, it is recommended that the chimney flue be warmed by a gas blow-lamp or similar heating device for about 10 min. The ashpit door of the heating appliance and thermostat (if fitted) should be in the closed position. Any soot doors or flue pipe access doors should be closed.

Smoke pellets should be placed in the heating appliance firebox or the bottom of the chimney or the heating appliance recess and ignited. If the chimney is metal lined it is important that the pellets are suitable for use in metal chimneys. When smoke starts to form, the heating appliance, heating appliance recess or the bottom of the chimney should be restricted, and the smoke allowed to drift upwards. When smoke is observed rising from the chimney, the terminal should be partially sealed to leave only a 50 mm diameter opening to the atmosphere.

An inflatable ball bladder is ideal for this as it will accommodate any variation in dimensions. Alternatively a plastic bag can be placed over the terminal and sealed around the edges.

The chimney and flue pipe (if fitted) should be observed throughout its length to check for tightness. The smoke test should be allowed to continue for at least 5 min. Significant discrete leaks should be investigated and a pressure test carried out in accordance with N.3.3 if necessary.

N.3.3 Gas tightness test

Method A: Pressure test

Undertake the pressure test at ambient temperature.

Seal the chimney outlet with an air tight seal. In order to ensure that the chimney ends are suitably closed, the manufacturer may supply an adapter. Ensure that any other openings are closed, including any drainage systems.

Connect an air supply and flow meter to the chimney using air tight seals. Connect a manometer directly to the flue. Deliver air from the air supply to the flue at a rate necessary to achieve and maintain the test pressure appropriate to the chimney designation (see EN 1443:2003, Table 5).

Record the airflow rate.

WARNING — For safety reasons it is recommended to test positive pressure chimneys on site with no higher pressure than 200 Pa. Care should be taken in any case with positive pressure tests on site. Any end caps should be fixed and tightened very careful.

A satisfactory leakage rate is achieved if the maximum leakage value is no more than that specified in EN 1443:2003, Table 5. If a satisfactory leakage value is not achieved the reason should be investigated. However for negative pressure chimneys, if a leakage value of more than two thirds of the allowed leakage is recorded than further investigation is recommended in order to establish whether the leakage is occurring as a result of a single opening in the flue or whether the leakage is of a more general nature (general: see EN 1443). Leakage via a single aperture should be corrected.

Method B: O_2 measurement in concentric air supply ducts for gas

By measuring the O_2 concentration in the combustion air at the entry to the heating appliance, it is possible to detect any flue gas entering the combustion air.

The limit values for the decreased O_2 concentration depend on the construction or location of the terminal.

Acceptable values are:

1. chimneys where recirculation is not possible, if the reduction in the O_2 content is not more than 0,4 % by volume and

2. chimneys where recirculation is possible, if the reduction in the O_2 content is not more than 2,0 % by volume (for chimneys, e. g. with a rain cap or outlets under a cantilever roof)

from the reference value.

The reference value is the value after calibration of the measurement instrument. It is possible to calibrate the measurement instrument with the air in the installing room. In case of contaminated combustion air, in factories and workshops for example, the calibration shall be done in the outer air.

NOTE: Examples:

The result of the calibration before the start of the measurement is: 20,8 % by volume O_2.
The result of the measure is: 20,2 % by volume O_2
The decrease is: 0,6 % by volume.
In case of No 1 the requirement is not fulfilled,
In case of No 2 the requirement is fulfilled.

Annex O
(informative)

Recommendations for inspection, cleaning and maintenance

O.1 General

The installer should ensure that the information of O.2 and O.3 is given to the user.

O.2 Inspection and cleaning

The effectiveness and the safety of a chimney are dependent on proper and regular cleaning and/or inspection. Chimney cleaning and/or inspections should be documented.

This documentation should be kept by the user and/or the competent person.

A programme of cleaning should be introduced as necessary.

The normal method of cleaning should be by the use of a brush, which for a plastic chimney should not be of steel and for metal lined chimneys the brush should not be made from black steel. Any variation from the normal method should be in accordance with the manufacturer's cleaning instructions.

NOTE It is recommended to inspect a chimney at least once a year by a competent person.

O.3 Maintenance

The chimney should be maintained as necessary to ensure that the construction remains in good condition. Any component showing signs of deterioration which affects performance should be replaced under professional advice and any evidence of leakage should be rectified.

Bibliography

[1] EN ISO 13732-1, Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)

[2] CEN/TR 1749, European scheme for the classification of gas appliances according to the method of evacuation of the combustion products (types)

[3] EN 1859, Chimneys – Metal chimneys – Test methods.

[4] EN 12391-1, Chimneys - Execution standard for metal chimneys - Part 1: Chimneys for non-roomsealed heating appliances.

[5] EN 13216-1, Chimneys - Test methods for system chimneys - Part 1: General test methods.

[6] EN 13501-2, Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests, excluding ventilation services.

[7] EN 14297, Chimneys – Freeze-thaw resistance test method for chimney products.

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National Annex NA (informative)
Chimneys to be used with gas and oil appliances

NA.1 General

Clauses 4 and 5 require chimneys to be in accordance with national regulations and nationally accepted rules. This National Annex NA (informative) identifies sources of such regulations and accepted rules that apply in the UK.

NA.2 National regulations

Attention is drawn to the following regulations which contain requirements that impinge on chimney design, installation or commissioning.

a) The building regulations for the appropriate UK legislative region:

   — The Building Regulations for England and Wales;

   — The Building Regulations (Northern Ireland) Statutory Rules;

   — The Building Standards (Scotland) Regulations;

   — The Building Regulations (Isle of Man).

b) The Gas Safety (Installation and Use) Regulations.

NA.3 Nationally accepted rules

The following list includes documents that complement EN 15287-2 in some particular detail and have been accepted by a formal process within industry, a trade body, professional institution or have government department approval and used within the UK and can therefore be used with this standard.

NA.3.1 Miscellaneous accepted rules

GID1 Essential Gas Safety – domestic: CORGI publication

TTG1 Terminal and Termination: CORGI publication

IGE/UP/7 Gas installations in framed buildings: Institution of Gas Engineers and Managers

IGE/UP/8 Gas in caravans, holiday homes and boats: Institution of Gas Engineers and Managers

IM/28 Appliances in commercial garages: Institution of Gas Engineers and Managers

IM/11 Flues for commercial and industrial sized boilers and air heaters – A guide to the assessment of chimney heights and flue design. Institution of Gas Engineers and Managers

NA.3.2 Standards publications

NOTE The British Standards marked below with an asterisk (*) will be revised to complement BS EN 15287-2.

BS 715, *Specification for metal flue boxes for gas-fired appliances not exceeding 20 kW*

*BS 5410-1, *Code of practice for oil firing. Installations up to 45 kW output capacity for space heating and hot water supply purposes*

*BS 5440-1, *Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70kW*

*BS 5546, *Specification for installation of hot water supplies for domestic purposes using gas-fired appliances of rated input not exceeding 70 kW*

*BS 5854:1980, *Code of practice for flues and flue structures in buildings*

BS 5871, *Specification for installation and maintenance of gas fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances*

BS 6644, *Specification for Installation of gas-fired hot water boilers of rated inputs between 70 kW (net) and 1.8 MW (net) (2nd and 3rd family gases)*

*BS 6798, *Specification for installation of gas-fired boilers of rated input not exceeding 70 kW net*

BSI - British Standards Institution

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